ENGINEERING NEWS

A JOURNAL OF CIVIL, MECHANICAL, MINING AND ELECTRICAL ENGINEERING

Vol. No. 16. 220 Broadway, New York, October 15, 1908.

TABLE OF CONTENTS.

	Page.
LEADING ARTICLES:	
A Proposed Freight Subway Belt Line for Lower New York City (illustrated); Francis W. Lane	403
Convention of the Illuminating Engineering Society	405
Seventy Cent Costs of Reclamation Service Work	407
The Reinforced-Concrete Covered Reservoir for the Indianapolis Water Co. (illustrated); William Curtis Mabee, C. E.	408
Modern Land-Pebble Phosphate-Mining Plants in Florida (illustrated); H. D. Hendenhall, Jun. M. Am. Soc. C. E.	410
Pavement Underpinning for the Paris Subway of the Paris & Orleans Ry.	415
The Story of a Remarkable Propaganda	416
The Crocker-White Turbine Governor (illustrated); W. M. White and L. F. Moody	417
Some Special Designs of Rails and Tie-Plates (illustrated)	418
More Concerning English Highways. [Editorial Correspondence]	420
Reinforced-Concrete Caissons for a Breakwater at Algoma, Wis. (illustrated); W. V. Judson, M. Am. Soc. C. E.	421
The Lakes-to-the-Gulf Deep Waterway Convention	422
EDITORIAL	419
Work Train Collisions—The Underpinning of Tunnels in Soft Materials—Progress in Good Lighting—Floating Reinforced-Concrete Blocks Twelve Miles to a Breakwater.	
A Plan for Subway Freight Distribution in New York City	419
ENGINEERING NEWS OF THE WEEK	424
PERSONALS	425
ENGINEERING SOCIETIES	425
ENGINEERING LITERATURE SUPPLEMENT	427

A PROPOSED FREIGHT SUBWAY BELT LINE FOR LOWER NEW YORK CITY.

By FRANCIS W. LANE.*

In a report recently presented to the Public Service Commission of New York, Mr. W. J. Wilgus, President of the Amsterdam Corporation, and formerly Vice-President of the New York Central Railroad, outlines a plan for materially improving the freight-handling facilities of the city and port of New York. The report discusses at length the "west-side problem," as presented by the freight tracks of the New York Central along the North River, the requirements of commerce, of the public and of the carriers, and proposes a solution of the problem.

In general terms, the solution consists in the construction of a freight subway under the marginal streets of Manhattan, extending along the North River from 60th street to the Battery and along the East River from the Battery to Mott Haven or some point in that vicinity on the north side of the Harlem River, and connecting with the railroad terminating in New Jersey. The present article is a condensation of the subject-matter of the report.

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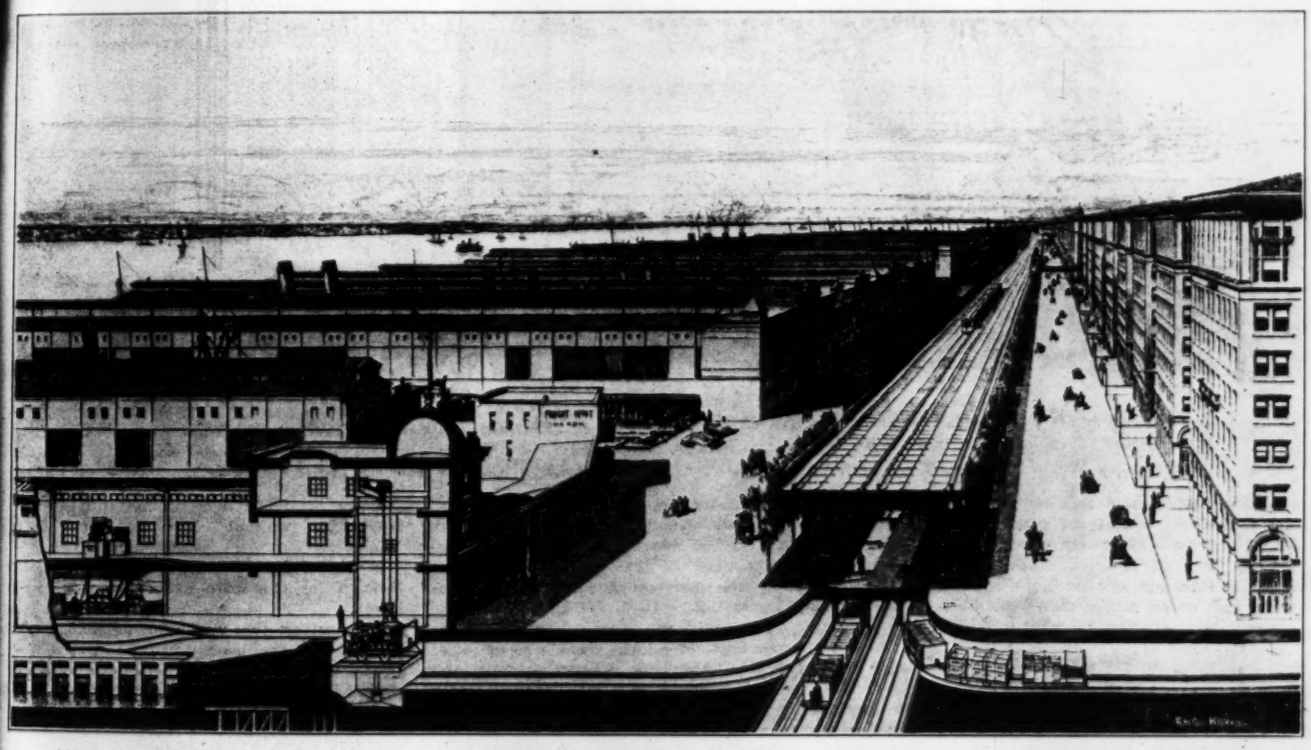
Aside from the general congestion in the down-town streets and along the river fronts of Manhattan, the presence of the tracks of the New York Central along the North River have for several years constituted a source of danger and annoyance, and various attempts have been made to provide a substitute. None has so far been found which will at the same time serve the interests of traffic and preserve the rights of the railroad company.

Within the territory covered there are four large freight terminals—at Manhattanville, 60th street, 33d street and St. John's Park. In these yards is handled the tonnage originating on the 50,000 miles of territory served by the New York Central lines which is intended for local consumption in New York City or export.

Eleventh avenue has been the principal point of objection to the continuance of the railroad company's lines on the surface. In 1906 the Leg-



VIEW OF PROPOSED SUBWAY SYSTEM FOR FREIGHT DISTRIBUTION IN SMALL CARS ON WEST STREET, NEW YORK CITY, AND ELEVATED PASSENGER RAILWAY ABOVE.

The history of what has of recent years come to be known as the "west-side problem" is briefly as follows:

The Hudson River R. R. Co. was incorporated in 1846, and in 1869 it became consolidated with the New York Central R. R. Co. By ordinances and contract in 1847, the company was authorized to construct a double-track railroad from Spuyten Duvil, at the northern extremity of Manhattan Island, along the company's own right of way on the bank of the Hudson to 60th street, intersecting some nineteen streets at grade, and thence upon the surface along Eleventh and Tenth avenues and West street to Canal street.

The present extent of this double-track main line on the west side of Manhattan is about 12 miles, of which four miles are along city streets.

islature passed the so-called Saxe law, providing that the Board of Rapid Transit Commissioners, the predecessor of the present Public Service Commission, should come to agreement with the railroad company for the depression of tracks into subways in and across all streets and public places from Spuyten Duyvil to St. John's Park, or in default of agreement should condemn the property and rights of the railroad. An alternative plan, suggested by the Chief Engineer of the Commission, provided generally for carrying the streets north of the 60th street yard overhead, leaving the tracks on the present level. The estimate of cost was from $30,000,000 to $34,000,000.

At a conference, held early in 1907, the company agreed to build a six-track subway in Eleventh avenue from 30th to 60th streets, and

thence northward on substantially the existing grades, with intersecting streets carried overhead, and to abandon the use of steam for its main-line operations south of Spuyten Duyvil. South of 30th street no solution was offered. This plan, though approved by the Commission, conflicted in some points with the Saxe law, and a new bill, embodying the required amendments, failed of passage in the Legislature.

The Public Service Commission, in conformity with the Saxe law, has taken formal steps toward condemnation proceedings, and the solution of the problem is now subject to the delay likely to result from legal proceedings, though both parties are apparently desirous of reaching an amicable agreement.

But this proposed depression of the tracks along the river front, expensive as it is, would be only a beginning toward solving the difficulties of freight transportation and distribution on Manhattan Island, and some new difficulties would be created. The abolition of the present yards

creased freight rates. None of these plans, it is added, relieves the objection to the entrance of standard cars to lower Manhattan.

The plan proposed by Mr. Wilgus for solving not only the difficulties facing the New York Central lines, but the general problem of economically handling freight on lower Manhattan Island, consists in the construction of a system of subways designed for small cars only. The type of car proposed would have sufficient capacity to accommodate the largest packages of merchandise.

The subways would have a width and height of about 8 ft. 6 ins. for each single track. As shown by the accompanying map, these subways would be located on the marginal streets surrounding Manhattan Island, and would be connected not only to the New York Central lines, but though a four-tube tunnel under the North River with the railways terminating on the New Jersey side. Branches and spurs from the subway would lead to warehouses and industrial establishments and to the piers all along the water front. Of course the piers would have to be reached by means of elevator towers back of the river bulkhead and docks along the line, as shown in the accompanying engravings. It is estimated that the subway cars are large enough to handle at least 90 per cent. of all the commerce of lower Manhattan, with but one change of bulk and that made at points remote from the congested portions of the city. It is proposed to use electricity as a motive power, and to so construct the cars that they can be easily handled on steep grades and sharp curves and on elevators.

Mr. Wilgus's plan differs from that of the freight subway in Chicago in that its proposed location is immediately beneath the streets instead of some 40 ft. below the street level. It is argued that this feature will eliminate the expense of connections between the subway and the adjacent industries; will not interfere with the use of the streets for future passenger subways, and will cause minimum interference with sewers and other subsurface structures.

The structural difficulties are greatly reduced by the fact that the subway is designed for small size cars and hence the tunnels will be shallow. It is thought that the bottom of the excavation for the subway will be not more than 11 to 11½ ft. beneath the street surface. As the surface of West St. is very little above the highest tide levels and the soil is sandy, this reduction in the subway depth compared with what would be required for a subway to accommodate standard freight cars is ... important. It is also important in connection ... with the city sewers as the shallow subway will ... erally have room to pass beneath the crown ... the sewer and the street surface, while the ... ger subway would require a siphon at every ... r.

Perhaps the most important ... ure of Mr. Wilgus' scheme is his careful pro... ion that his main lines shall not be blocked ... switching movements. As shown by the ty... plan, grade crossings are eliminated at di... ng points, and the principle is adhered to th... traffic movement shall always be in one di... on and reverse movements are not allowed. ... cars are to be operated by electricity on th... ultiple unit system, so that a train can be split ... and moved in sections for distribution witho... delays involved by switching with a loco... tive at the head. Traffic to and from the ... transfer station on the Hackensack meado... would be carried by trains each designed for ... particular district, and of such length that ... arrival at that district it could be promptly diverted to its destination without obstruction of the main tracks.

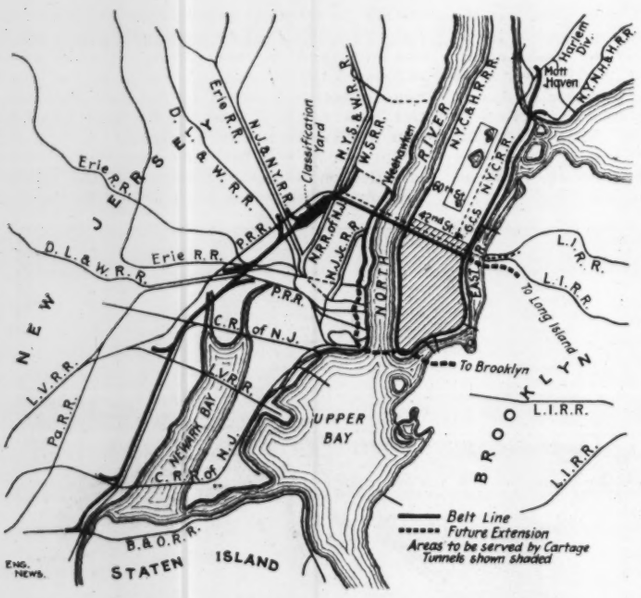


FIG. 1. MAP OF PROPOSED MARGINAL FREIGHT SUBWAY SYSTEM FOR MANHATTAN ISLAND, NEW YORK CITY.
Proposed by Wm. J. Wilgus, M. Am. Soc. C. E.

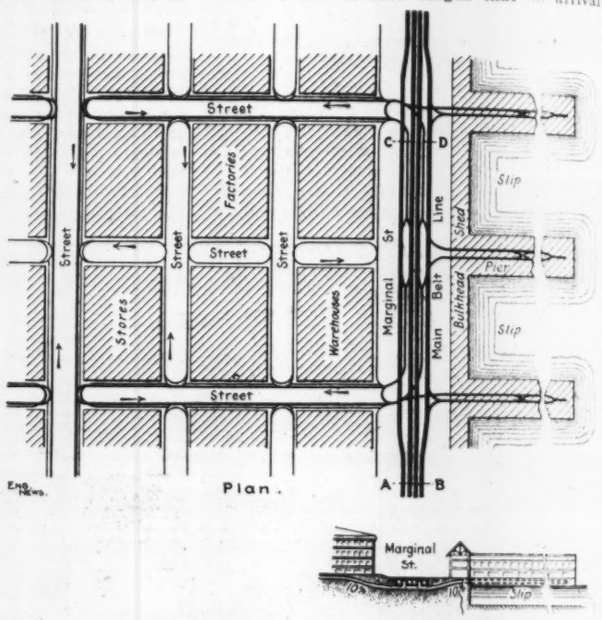


FIG. 2. PROPOSED PLAN OF TWO BLOCKS ON THE WATER FRONT, SHOWING FREIGHT SUBWAY SYSTEM AND CONNECTIONS, WITH PROFILE SHOWING CONNECTIONS TO PIERS.

on the west side would require the railroad to secure equivalent water-front space for handling the 5,000,000 tons of freight now entering the island by way of Spuyten Duyvil, while the commercial interests of New York have already declared that more, rather than less, dock space is required by the ocean carriers if New York is to compete successfully with its rivals.

The plan proposed by Mr. Wilgus is designed to afford access to Manhattan Island by all railroads serving the Port of New York, and to relieve the congestion along the water front and in the lower part of the city by affording a means of distributing freight which shall serve as a substitute for much of the haulage by drays in the streets that is now required. Of the three methods that have been suggested for the solution of the "west-side problem," it is contended that the complete removal of the tracks of the New York Central, south of Spuyten Duyvil is antagonistic to the interests of the public and the port because of the enormous expense imposed upon the public for the value of the property taken, the damages to the company for the loss of its principal freight terminal and the necessity for encroaching further upon an already limited water-front space. The depression of the tracks at all streets and in public places is physically and financially impracticable. The third plan, which was formerly agreed upon by the railroad and the Commission, would entail an expense of some thirty or forty million dollars, and impose a burden of about 50 cents per ton, to be made up in in-

In the report in question, the advantages claimed for this plan are summed up as follows:

1. It solves the west-side problem, securing to the city the benefits of the elimination of tracks at grade in city streets, the abolition of steam locomotives and the betterment of the park districts.

2. It releases the New York Central from the necessity of an unprofitably large capital expenditure, estimated at $40,000,000.

3. It renders feasible rail connections to industries and the water front.

4. It avoids interference with the use of marginal streets for passenger railways.

5. It relieves the city streets from vehicle traffic, thus reducing noise, cost of pavement repairs, congestion of sidewalks and pavements, delays to street cars and cost of street cleaning and disposal of waste products.

6. It relieves congestion in the harbor navigation.

7. It makes practicable the access to Manhattan Island of all railroads by rail connection direct to shippers.

8. It releases docks and piers from railroad uses, thus permitting their occupation for the expansion of water traffic and thereby facilitating the commerce of the port.

It has been roughly estimated that the cost of such a system as that outlined would be from

$80,000,000 to $100,000,000. While this seems a large sum, it is claimed that the saving through the operations of the proposed system would be sufficient to pay all operating expenses, maintenance charges and interest on the investment and leave a margin of at least $15,000,000 per annum over the amount at present expended on doing the same work.

Lest this estimate be thought an extravagant one the following figures taken from Mr. Wilgus' report are appended to show the enormous cost, approaching $35,000,000 per annum, of the transfer of freight between carriers and consignees or warehouses in New York City under the present methods.

From the carriers and other authoritative sources the following information has been obtained, applicable to the year 1906-07:*

APPROXIMATE TONNAGES OF THE PRINCIPAL RAIL AND WATER CARRIERS REQUIRING DRAYAGE IN MANHATTAN:

Carriers.	Merchandise, tons.	Coal, tons.	Total tons.
Railroads: Rail delivery..2,000,000 Water delivery.7,800,000	9,800,000	4,000,000	13,800,000
Foreign steamship lines: Terminating on Manhattan Island .....1,400,000 Terminating in New Jersey... 800,000	2,200,000	.....	2,200,000
Coastwise lines (incomplete)	2,900,000	.....	2,900,000
River and Sound lines (incomplete)	1,300,000	.....	1,300,000
Irregular lines (incomplete).	3,000,000	.....	3,000,000
Totals	19,200,000	4,000,000	23,200,000

The cost of handling this tonnage is of vital importance. With the exception of the portion of the New York Central tonnage that is drayed to and from its rail terminal on Manhattan Island, all freight carried by the railroads requires lighterage and break of bulk on the water front. The cost of the lighterage in connection with this service was investigated by the New York Commerce Commision in 1908 and was found to widely vary, depending on the class of freight, the method of water transportation and the places of distribution. The average result, however, including interest, depreciation, taxes and insurance on plant and structures, and cost of wages and supplies, was shown to vary from 83 to 88 cts. per ton. No conclusive evidence was produced as to terminal costs on both sides of the river, including rentals, handling of freight and similar items; but data have been obtained from other authoritative sources. The cost of cartage on the city streets is found to vary, depending on the length of haul and the character of freight. For certain commodities it is as low as 60 cts. per ton, and for others as high as $1.25 or more per ton. An average of 80 cts. per ton is considered to be a conservative figure.

The following estimates of the cost of handling freight from the outlying yards of the railroad companies west of Bergen Hill, N. J., and 60th St., New York, to the shipper, are believed to be low rather than high.

Railroad Merchandise.

Terminal costs on the New Jersey side of North River and at 60th St....	$0.15 per ton
Lighterage or equivalent charges	.80 per ton
Terminal cost on water front, Manhattan Island.....	.50 per ton
Cost to railroads	$1.45 per ton
Cartage, defrayed by shippers.....	.80 per ton
Total cost from outlying yards to shippers.	$2.25 per ton

Coal:

Handling, storage and lighterage or ferriage.....	$0.40 per ton
Cartage	.60 per ton
Total	$1.00 per ton

Steamship Merchandise:

Cartage	$0.80 per ton

Based on these figures the approximate annual terminal charges at Manhattan Island for the tonnage handled by the principal carriers, exclusive of the large traffic of the minor carriers, are:

9,800,000 tons at	$2.25.....	$22,050,000 per annum.
9,400,000 tons at	.80.....	7,520,000 per annum.
4,000,000 tons at	1.00.....	4,000,000 per annum.
23,200,000 tons.....		$33,570,000 per annum.

In addition to the tonnage passing between the carriers and the shippers, there is a large volume of business that is redistributed from manufactories and warehouses to consumers. Owing to the time required to obtain reliable information on this feature, no attempt has been made to include it in this report; but in seeking for a solution of the freight problem, the necessity for more economical and expeditious methods of subdistribution should not be forgotten.

Another important use of the system will be for the transportation of street sweepings, garbage, ashes, excavated materials and snow.

The time required to perform this handling enters as an important element into the consideration. Under favorable conditions the minimum time now required for the transfer of freight from the New Jersey side of the river to the consignee in Manhattan is from three to six hours; and interruptions caused by fogs and snowstorms raise the average time to a higher figure.

Mr. Wilgus's report upon this important subject is receiving the careful attention of the Public Service Commission of New York, of representatives of the city's commercial interests and of financiers.

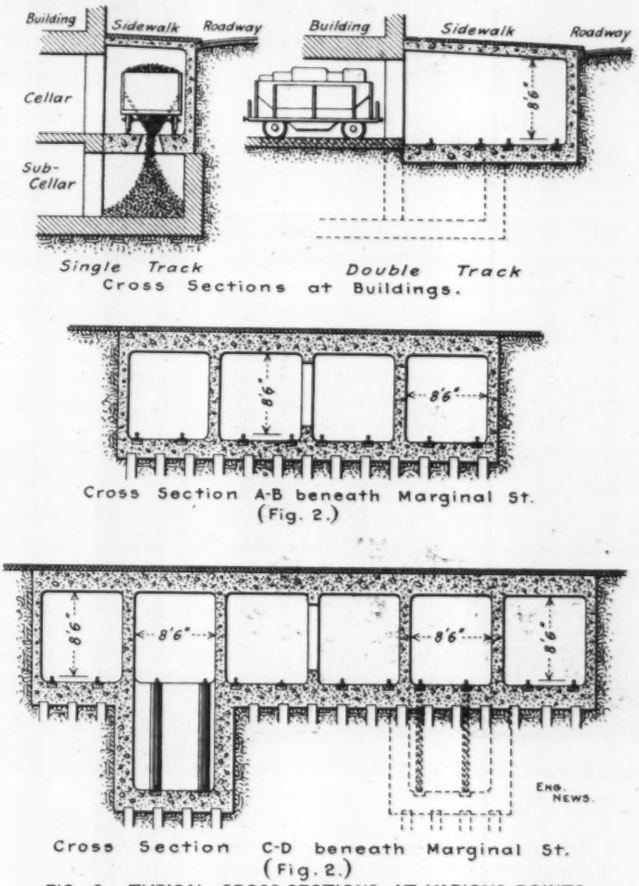


FIG. 3. TYPICAL CROSS-SECTIONS AT VARIOUS POINTS.

CONVENTION OF THE ILLUMINATING ENGINEERING SOCIETY.

The second annual convention of the Illuminating Engineering Society was held at Philadelphia, Oct. 5 and 6. Considering the youthfulness of this society the attendance was remarkable, there being registered 242 members and 158 guests. The attendance at the professional sessions was about 250. The entertainment features were partially in connection with the Founder's Week Celebration, commemorating the 225th anniversary of the founding of Philadelphia.

The presidential address of Dr. Louis Bell, of Boston, was a plea for greater attention to the practical side of street lighting and for a less dependence on measured values for horizontal or nominal illumination. Greater diffusion, decreased brilliancy, better distribution and more light were advised. Several comparisons were made between American and European practice which latter, it was claimed, was usually ahead of anything generally used in this country.

Mr. H. T. Owens presented a descriptive paper entitled "Street Lighting Fixtures and Illuminants," in which the common street-lamp fixtures for all gas and electric services in this country were illustrated. Comparisons were made with European types, rather unfavorable to the American fixtures in both utility and appearance. The author incidentally called attention to the fact that 45% of the street lighting in this country was by gas service, and that this was largely with inefficient open-flame burners.

Mr. E. N. Wrightington, of the Boston Consolidated Gas Co., in a short paper called attention to the use, in Europe, of inverted and high-pressure gas lamps in large candle-power units. He also noted a prevalent practice, greatly in contrast with American custom, whereby the stores and windows were wholly dark, contributing nothing to the street illumination. This was found to hold true even where there was heavy foot and vehicular traffic.

The committee on nomenclature and standards presented a report which described the progress attained in securing an "international candle" or unit of light strength. It was reported that a joint committee of the American Institute of Electrical Engineers, the American

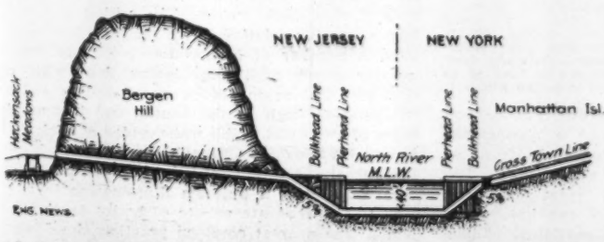


FIG. 4. PROFILE OF PROPOSED LINE UNDER THE NORTH RIVER.

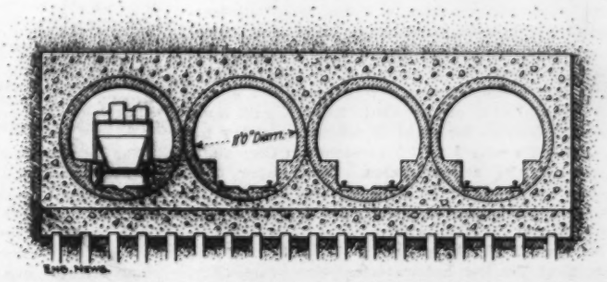


FIG. 5. TYPICAL CROSS-SECTION OF NORTH RIVER TUNNEL LINE.

Church Street.

Mercer Street.

Leonard Street.

FIG. 6. SOME TYPICAL CONGESTED STREETS IN LOWER MANHATTAN, NEW YORK CITY.

Gas Institute and the Illuminating Engineering Society had organized and had adopted resolutions expressing its views and desires. These resolutions declared that a unit of candle power which would be a compromise between the units used in gas and electric-lamp photometry in this country would be close to the mean value of the units used in the national laboratories of this country, England and France. These resolutions approved the adoption of a unit which would be a mean of the standards maintained at these three national laboratories and advised the use of a unit in this country, during the interval required for the consummation of international action, that would be 2% less than that now used at the Bureau of Standards.

Dr. A. H. Elliot, of the Consolidated Gas Co., New York, in a paper on the illuminating values of petroleum oils presented the results of three years work in an investigation into the burning of petroleum notably kerosene, 48° to 50° Baume and 150° flash to develop a lamp which would serve as a good working standard for flame photometry as demanded in gas-works photometry. Flat wick burners were found the most advantageous and in these, if a "student-lamp" constant-level reservoir was used, kerosene could be burned for ten hours with less than 5% change in the candle power of the flame. By using a slotted screen which selected a certain desired area of the whole flame the oil lamp could be burned for eight or ten hours a day for a week with only 1 to 2% variation in the candle power of the selected area. The paper contained much tabulated data on the behavior of various petroleum oils in flat, double and round-wick lamps.

Messrs. C. H. Sharp and P. H. Millar, of the Electrical Testing Laboratories, New York City, described an adaptation of the Ulbricht integrating sphere for easily and accurately measuring the mean spherical candle-power and total light flux emitted by a light source. This sphere is a large attachment for a photometer usually surpassing the latter itself in relative size, and consists esentially of a hollow sphere coated on the inside with a white diffusing paint and containing the light source under study. In the side of the sphere is a small translucent window whose brightness, when the direct rays from the lamp are screened from it, is directly proportional to the total luminous flux given off by the lamp or to its mean spherical candle-power. It has been found possible to build and use these spheres with diameters from 11 to 80 ins. The illumination on the test window, of course, is measured by ordinary photometric means and this involves no difficulties. Each sphere needs to be calibrated to correct for the small absorption of the interior, etc.

Dr. H. E. Ives, of Washington, D. C., described a "colorimeter," designed by Mr. F. E. Ives, for describing the light emitted by a source, or reflected by a body, in terms of normal red, green and blue. The principle of this instrument depends on the well-known fact that the mixture of spectral red, green and blue light in various proportions will reproduce, to the eye, white and all the hues met with. The instrument was briefly described as follows:

> It consists essentially of an oblong box, at one end of which are placed four slits, one clear, the three others furnished, respectively, with a red, a green and a blue color screen. By means of levers the openings of the three colored slits may be altered to read by scales from 0 to 100. Within the instrument is a wheel of lenses which when rotated rapidly by a small motor causes the three colors to pass across the field of vision of an eyepiece, thus mixing them by persistence of vision. The optical arrangements are such that one observes a divided field, one-half consisting of the mixture of three colors, the other the color to be matched, as viewed through the clear slit. For ordinary use a white surface reflecting the light of the sky serves as standard white, the fabric observed being illuminated by the same light. To make a measurement, the three levers are opened until white is matched, and the scales are adjusted to read 100 for each color (this method compensates for slight differences in color vision of different eyes); then any color matched by moving the three levers can be read off in terms of the red, green and blue used to match white.

For measuring colored light a different method is needed. As a measured and a comparison source are both in use, the region in front of the instrument is divided by a partition. The light to be studied is allowed to fall on a flat surface of magnesium oxide placed before the clear slit on one side of the partition. Light from the comparison source is passed through the red, green and blue screens and the studied source is described in terms of the red, green and blue of the comparison source. This is later compared with "normal daylight" and the proportions of red, green and blue light in the studied source are reduced to terms of the normal daylight.

Messrs. J. R. Cravath and V. R. Lansingh presented "The Calculation of Illumination by the Flux of Light Method." Their method, an adaptation of earlier proposals, depends primarily in finding the total flux of light thrown out between certain limiting directions, by the light source with its shades, etc. The unit of luminous flux, the lumen, has been already defined as that passing from a 1-c.-p. source to an area of 1 sq. ft. at a distance of 1 ft., from the source. This area also has an illumination of 1 candle-ft. Average candle-feet may be determined by dividing total lumens received by the area in sq. ft. Total lumens emitted by a source are numerically equal to 12.57 times the mean spherical candle-power, from the relations of solid angles. The authors show graphical means of easily finding the total lumens emitted by a source in the direction of the lighted area. This figure divided by that area gives the desired value of average illumination. The effect of ceilings and walls in reflecting light not thrown in the direction of the lighted area is neglected.

Mr. A. A. Wohlauer, of New York, in "Engineering Problems in Illumination" discussed the possible ways of securing uniform illumination over a limited area from a single lamp unit and uniform illumination over a large interior area from a number of distributed lamp units. The former would naturally be employed in certain living rooms or for desk and local lighting in libraries, etc., while the second kind of illumination would be adapted to auditoriums, stores, etc., and for the general illumination of libraries. The paper contained a few general remarks on the design of reflectors for both kinds of service.

Messrs. V. R. Lansingh and T. W. Rolph, of the Holophane Glass Co., New York City, reported the data from a series of tests on reflections from the ceiling, walls and floor of a room. The eight possible combinations of light and dark ceilings, walls and floor of a room about 12 × 25 ft., were tried with various groups of lamps and prismatic reflectors, the lamps being very close to the ceiling. In all cases the effect of the floor was of only slight value. The ceiling and walls had a greater relative effect on the illumination with a number of lamps than with one and a greater effect with bare lamps than with reflectors. The ceiling alone was found to add an illumination high in the center and low at the sides of the room. The walls added a fairly uniform illumination though somewhat higher toward the center. The interaction of ceiling and walls gave a uniform illumination in addition to the separate effects of both. In the case which was nearest common practice, three lamps with reflectors on the center line of the room, the

following additions to the direct average illumination:

[illegible] ceiling	29%
[illegible] walls	26%
[illegible] ceiling and walls (plus separate effects)	37%
[illegible] ceiling and walls (total)	92%
[illegible] floor	0%
[illegible] ceiling, walls and floor (total)	150%

L. B. Marks in a paper described the [illegible]ne worked out for lighting the Carnegie [illegible]ches of the New York Public Library, with particular attention to details and data derived [illegible] the installation in the St. Gabriel's Park [illegible]anch. The noteworthy points of the design lay [illegible] the freedom from glare by shading all lamps [illegible] in cutting down intrinsic brilliancy of the [illegible]mps to 1-10 c.-p. per sq. in.; in the general illumination of 1 candle-ft. reinforced at reading tables by a local illumination of 5 candle-ft.; [illegible] a horizontal illumination on book shelves of [illegible] to 8 candle-ft. and a vertical value of 1.5 to [illegible]; in providing reading-table lamps with prismatic reflectors to throw the maximum light sideways instead of downward; and in the general cheerful effect resulting in the evening.

Mr. T. J. Little, Jr., of the Welsbach Co., Gloucester, Mass., described the means employed to light modern gas lamps without resorting to matches. These apparatuses were divided into two classes; electric and pneumatic. The former are of the familiar "make-and-break" and "jump-spark" design, adapted to pilot-tube ignition, while the latter have an air-operated valve and a pilot flame burning normally. The air-operated gas valve is operated by a small piston switch, at some convenient point, air pressure being communicated by a concealed tube of small diameter. The discussion on this paper centered around the failure of electrical gas-lighting apparatus through insufficient insulation. The question of danger from accumulations of gas from extinguished pilot flames was brought up and a variety of experiences were given, all tending to show that there is little chance of the protected pilot flame's being extinguished and even in such event a few days' continual escape of unburned gas is necessary before its presence can be detected.

Mr. L. J. Lewinson, of New York City, gave the results of a series of tests on sunlight illumination, carried out on the roof of the Electrical Testing Laboratories in New York City. Here there was practically no obstruction to sky light. A tremendous rate of change was found in the hour preceding sunrise, the intensity of illumination a few minutes before actual sunrise being ten thousand times the value an hour previous. During the hour after sunrise the rate of increase was relatively small, the actual increase of illumination at the end of the hour being about of the order of 10 times that at the beginning. A very regular increase was found from 6 a. m. to noon and a correspondingly regular decrease from noon to 6 p. m. In the hour following sunset there was a rapid diminution though the rate of change actually observed was about a third that in the hour preceding sunrise. The following statements summarize some of the data:

Certain cloud formations have the effect of increasing the intensity of illumination by diffusion. Other clouds act as absorbing media, and decrease the illumination intensity. Variations in intensity due to clouds, are often of a large order, and sometimes occur suddenly.

The skylight value at night, when there is no moon, is approximately 0.001 candle-foot.

The intensity of moonlight is about 0.014 candle-foot.

Daylight illumination varies in intensity from 2,000 to 8,000 candle-feet, between the hours of 8 a. m. and 4 p. m.

Mr. James R. Strong, of New York City, in a paper, "Structural Difficulties in Installation Work," reviewed the innumerable lighting changes that have to be made, particularly in a modern office building, to accommodate the changes in tenants' needs. As an aid to such changes and as a substitute for the resultant makeshift construction, the author proposed placing the outlets for the general office illumination on the center line of windows, on the ground that the high partitions are usually between windows. In addition,

if other outlets are placed around the ceiling a short distance inside the lines of partitions it would seem as if every possible requirement could be met by simple fixtures, and the outlets not needed could be capped up. This plan would probably involve a greater number of outlets in the original layout than absolutely necessary; but when it is considered that no changes would probably be required it will be appreciated that the additional first cost would be more than made up in saving in the maintenance cost of the first few years. Moreover, the installation as a whole would manifestly be a better one, owing to such freedom from changes and alterations, and as already pointed out, the offices would be more rentable.

The above general statements will also apply to any residence, in which class of work there seems to be a growing tendency to limit the number and capacity of outlets to the bare requirements of a scheme of decoration and furniture layout that has been decided on by the original owner, architect or decorator with no regard as to possible new requirements of a future purchaser or even changes desired by the original owner after he has become tired of a given color scheme or arrangement of interior. If the outlets were installed in number and capacity sufficient for the darkest probable treatment very little would be added to the first expense; and the decrease of the light to the exact amount required would then be done in the fixture and lamp.

Mr. Emile G. Perrot, of Philadelphia, in a brief paper mentioned the effect of lighting on the unity, grace and proportion of architectural details and made a plea for the cooperation of architects and illuminating experts that the desires of both might be consummated.

SOME RECENT COSTS ON THE RECLAMATION SERVICE WORK.

The U. S. Reclamation Service keeps a close supervision over the costs of work done on its extensive undertakings, both those done under contract and those done by force account. The following gives some interesting figures for recent work of the Service, from advance proofs of the "Reclamation Record."

SMALL REINFORCED-CONCRETE CULVERTS.—Two reinforced-concrete culverts on the South Canal of the Belle Fourche Project were built by force account, being completed on Aug. 20. They are made of 1:2½:5 concrete, and aggregate 494.4 cu. yds. The concrete was mixed by machine. The total cost of the work, including preparatory expense, plant depreciation, superintendence, camp maintenance, supplies, materials and labor, gives a unit-cost of $13.13 per cu. yd.

CONCRETE-TUNNEL LINING.—The tunnel of the same canal was lined with concrete by force account, during May to August, 1908. The cost of this work, covering 1,595 cu. yds. of concrete, was $15,531.10, or $9.75 per cu. yd. Under the specifications, however, payment would have had to be made on 1,712 cu. yds. (the excavation was much closer to line than the maximum overrun to be paid for), and on the basis of this yardage the unit-cost was only $9.07 per cu. yd. The distribution among the several items is given by Table I. below, which also gives the unit-cost items on the 1,712-yd. basis.

The tunnel is in shale. Its maximum height and width are 8 ft., and its total length 1,306 ft. It was lined with concrete on its full length, a 1:2½:5 mixture being used. Sand and gravel were obtained from pits at one end of the tunnel, and the mixer was located here. The nearest railway station is 18 miles away. Labor was plentiful; the average rate of wages was $2.30 per 8-hr. day.

ROCK TUNNEL EXCAVATION.—The Columnar Tunnel of the Main Canal, Tieton Project, a tunnel designed for a flow of 300 cu. ft. per sec., is 7 ft. in diameter, has a slope of 0.45%, and is 1,183 ft. long. Practically all of it is in basalt intermingled with volcanic debris. It was built between May 13, 1907, and April 20, 1908, by A. G. Moodhe, of Portland, Ore., under contract. The cost of the tunnel excavation is shown by Table II., which includes plant depreciation at 50% of original cost, power at 4 cts. per KW.-hr. (furnished the contractor by the United States at this price), and a penalty of $5 per day for 7 days for non-completion. About 84% of the sum given for supplies represents explosives.

The excavation of the approach cuts included 1,764 cu. yds. Of this, 1,435 cu. yds. consisted of loose material in which large rock fragments occurred in such quantity that no plows or scrapers could be used, while 329 cu. yds. were rock that required blasting (this includes detached masses of rock exceeding ½ cu. yd.). The approach excavation cost $0.89 per cu. yd.

DAM, CANALS, ETC. OF MINIDOKA PROJECT.—The gravity unit of the Minidoka Project (Snake River, Idaho) up to the end of the construction period gave the cost items summarized in Table III., where appears the subdivision into (1) construction, (2) engineering and (3) administration charges, and the percentage ratios of the two latter to the former. These ratios show large variations, which find explanation in the following notes:

MAIN DAM, SPILLWAY, ETC.—The work here consisted chiefly of placing a large volume of concrete and handling a large amount of rock and other material within a comparatively small compass. The work was not carried on at many points simultaneously, so that the cost of engineering was not so great as that on some of the

TABLE I.—COST OF CONCRETE LINING, SOUTH CANAL TUNNEL, BELLE FOURCHE PROJECT, U. S. RECLAMATION SERVICE.

(Done by force account. Unit-costs figured on basis of 1,712 cu. yds.; actual concrete, 1,595 cu. yds.)

Item.	Total cost	Unit cost.
Preparatory expense	$731.30	$0.43
Plant depreciation	725.73	0.42
Superintendence	318.00	0.18
Camp maintenance	430.03	0.25
Cement	4,544.11	2.65
Lumber and steel forms	861.08	0.50
Miscellaneous materials	45.20	0.03
Fuel	105.14	0.06
Lighting	81.43	0.05
Miscellaneous supplies	230.80	0.14
Repairs	.....	....
Hauling cement	1,624.25	0.95
Hauling gravel and sand	432.32	0.25
Crushing and screening gravel and sand	205.17	0.12
Mixing and placing concrete	1,585.71	0.92
Hauling forms	106.95	0.06
Labor on forms and runways	890.61	0.52
Blacksmith	137.19	0.08
Finishing	373.02	0.22
Miscellaneous labor	611.74	0.36
Administration	878.25	0.51
Engineering	633.07	0.37
Inspection	.....	....
Total cost to U. S.	$15,531.10	$9.07

Note.—Costs of survey and design are not included.

TABLE II.—COST OF TUNNEL EXCAVATION, COLUMNAR TUNNEL, TIETON PROJECT, U. S. RECLAMATION SERVICE.

Item.	Total cost.	Cost per lin ft. of tunnel.
Interest on investment	$300	$0.25
Preparatory expense	1,131	.96
Plant depreciation	2,052	1.74
Executive	500	.42
Labor	5,530	4.67
Power	1,049	.89
Penalty	35	.03
Supplies	1,257	1.06
Total contractor's cost	$11,854	$10.02

TABLE III.—GENERAL SUMMARY OF EXPENDITURES, MINIDOKA PROJECT.

Feature.	Building.	Engineering.	Administration.	Percentages. Eng.	Adm.	Total cost of feature.	Per cent. of project.
Dam, spillway, etc.	$485,687.00	$25,558.87	$7,786.50	5.3	1.6	$519,032.46	29.
Main North Side Canal	235,715.29	12,212.06	3,676.95	5.2	1.6	251,604.30	14.
Main South Side Canal	133,197.05	12,622.37	3,893.25	9.5	2.9	149,712.67	9.
"A" Branch and laterals	129,552.11	13,406.84	4,109.54	10.3	3.2	147,068.49	8.
"B"&"C" Branches & laterals	198,865.08	26,621.67	8,046.05	13.4	4.0	233,532.80	13.
Waste Canal "D"	16,467.32	3,646.16	1,124.72	22.1	6.8	21,238.20	1.
Bridges and structures	78,665.52	5,691.37	1,687.07	7.2	2.1	86,043.96	5.
Telephone system	11,702.70	1,593.80	432.58	13.6	3.7	13,729.08	.8
General force account work	196,382.96	27,208.06	9,906.15	13.9	5.1	233,497.17	13.
Right-of-way above Minidoka dam	24,760.00	3,778.43	1,167.98	15.3	4.7	29,706.41	2.
Right-of-way for Jackson Lake reservoir	2,300.00	641.49	216.29	27.9	9.4	3,157.78	.2
Jackson Lake Storage works (temporary)	22,583.82	2,117.20	1,211.23	9.4	5.3	25,912.25	1.5
Total expenditures for construction	$1,535,878.94	$135,098.32	$43,258.31	8.8	2.8	$1,714,235.57	.....
Total expenditures previous to construction period	.....	44,630.75	21,952.09	....	...	66,582.84	3.5
Total for project	$1,535,878.94	$179,729.07	$65,210.40	11.7	4.2	$1,780,818.41	100.00

other features. The main engineering cost on this feature was due to the work of staking out the masonry, involving considerable intricate form work, and of measuring the work for monthly estimates.

MAIN CANALS.—On the main north-side canal, the material handled was chiefly rock. The canal has a large section, contains several deep cuts and is only six miles long, so that the engineering expense was low. One assistant engineer and party staked out the work, made all estimates and supervised the construction. There was at all times enough work to keep every one connected with it busy. The main south-side canal is 13 miles long and about 20 ft. wide on the bottom, less than half the bottom width of the main north-side canal. There was about as much work per station for the engineering party (only one was needed) as on the north-side canal, so that, with the much smaller excavation per station, the percentage for engineering is higher.

BRANCH A AND LATERALS.—This work required the services of an assistant engineer with from one to two parties. The contractor was allowed the widest latitude in conducting his work with the result that the construction was carried on simultaneously at several points, requiring more than the average amount of engineering work. The bottom width of the canals and laterals varies from 40 ft. to only a few feet, and the total length of the system is about 34 miles.

B AND C BRANCHES AND LATERALS.—The construction of these canals (mostly small) comprised mainly earth excavation. The total length is about 60 miles. The work was sublet, was carried on at several points simultaneously and was conducted very slowly, so that a large engineering force was required for a long period. Three engineering parties were employed most of the time on the work. This accounts for the very high engineering percentage.

WASTE CANAL D.—This was built by a contractor with a small equipment. There was considerable expense involved in the preliminary and final location of the canal, but during construction only one small engineering party was employed.

OTHER FEATURES.—The construction of bridges and structures was carried on with a comparatively small force and continued over a long period. The structures were mostly small and were located so far apart as to require the services of an inspector for each structure. One assistant engineer with from three to five inspectors, with one instrument-man part of the time, was employed on this feature.

The construction of the Jackson Lake temporary storage works was done by force account and extended over two summers. There was necessarily considerable time lost in going to and from the work. The principal items in the cost of engineering are the survey of the reservoir site, the testing for the permanent dam site, the plans for the temporary works and the laying out of the construction work.

THE REINFORCED-CONCRETE COVERED RESERVOIR FOR THE INDIANAPOLIS WATER CO.

By WILLIAM CURTIS MABEE,* C. E.

During the summer and fall of 1907, the Indianapolis Water Co. built a reinforced-concrete pure-water reservoir, having a capacity of 5,500,000 gals., located at the Riverside pumping station of the company, on the bank of Fall Creek, about 500 ft. east of the pumps and extending easterly along Fall Creek 377 ft., and northerly 257 ft.

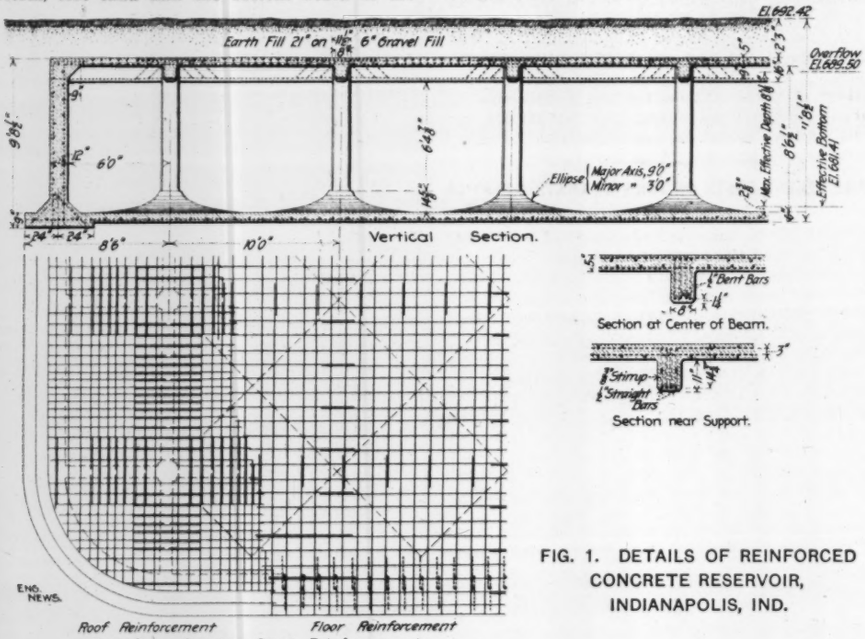


FIG. 1. DETAILS OF REINFORCED CONCRETE RESERVOIR, INDIANAPOLIS, IND.

This reservoir is the first of a series to be built from time to time as necessity demands, and piping connections are laid out with this point in view. It will conserve filtered water, and act as a compensating basin for the hourly fluctuations in pumpage, and will maintain a reserve storage supply very conveniently located near the pumps. The levels are such that when the reservoir is full the water stands 2 ft. above the discharge valves of the pumps, and when empty 6 ft. below, which is a much higher level than was possible with the open gallery. This structure replaces the open unlined gallery which was abandoned as a storage reservoir.

The design, as shown in Fig. 1, comprises a reinforced-concrete slab, supported on columns, which in turn rest on inverted groined arches. The cover consists of a symmetrical checker-work of beams 8 ins. wide and 16 ins. deep with a 5-in. slab supported by plain concrete columns 12 ins. square. This cover is supporting 2 ft. of earth fill, is built absolutely flat and level, and is drained by 4-in. farm tile, laid every 20 ft. in one direction. The floor of the reservoir is a reinforced-concrete groined arch bottom, as shown, having cold twisted bars ½-in. square spaced 10 ins. apart in both directions. The groined arch bottom was adopted for the purpose of transmitting upward pressures directly to the columns at times when the ground water is high and the reservoir empty.

The structure is built on a gravel bed just about level with the ordinary creek level. A rise in the creek brings the ground water up with it in a short time. The earth fill and the weight of the structure will counterbalance a rise of 6 ft. in the creek with the reservoir empty.

The bars are introduced in the arches to bond the sections together and to prevent contraction-cracks at the joinings. No waterproofing material was used other than washing the joints with neat cement grout. This has proved perfectly satisfactory and, in the writer's opinion, is the proper way to make a waterproof basin where clay puddle is not available. The proportion of steel to concrete in this case was 1-250th of the minimum cross section. From the writer's experience a concrete slab can be made absolutely monolithic and proof against contraction cracks if the proper amount of steel be used, and this amount varies with the exposure of the work, ranging from 0.2 to 0.5%, according to conditions. Besides being cheaper the writer believes the steel bars and a rich impervious concrete make a more nearly waterproof reservoir floor than the customary asphalt mixtures usually applied. In this case the cost of the steel in place, amounted to about 5 cts. per sq. ft., while for an asphalt coating the cost would have been nearly double this amount.

The walls were designed as vertical beams supported by the floor and roof capable of resisting pressure inward or outward. The corners of the wall intersections were rounded off on a 6-ft. radius, which proved to be a successful expedient for preventing contraction cracks at these points. Vertical bars in the walls were ½-in. square, spaced 12 ins. c. to c.; horizontal bars were ½-in. square, spaced 10 ins. c. to c. In the roof slab the spacing of bars was 5 ins. at the center of the panel, and 8 ins. at the sides.

COSTS.—The cost sheets did not include superintendence, equipment, interest or depreciation on equipment, pipe work or drain tile, but did include all labor and material used in the construction, the erection and maintenance of equipment, and office expenses. The work was all done by the water company's employees. With the above exceptions the cost was $9.33 per 1,000 gals. stored.

LABOR COSTS.

	Per day of 10 hours.
Common labor	$1.70
Concrete men	1.75 to $2.00
Form builders	3.00
Steel bar labor	1.50 to 1.75
Teams	4.00

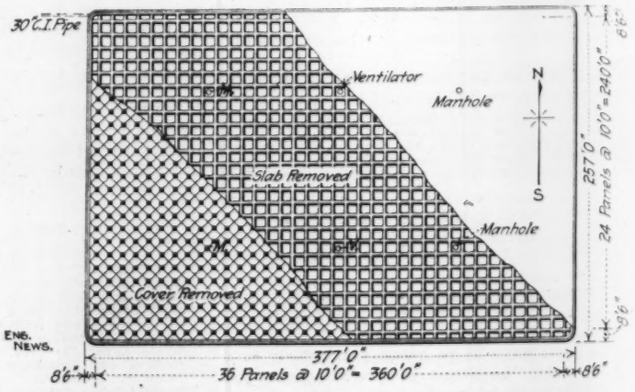


FIG. 1A. DIAGRAM PLAN OF INDIANAPOLIS RESERVOIR.

Reduced to the ratio of 1 sq. ft. of water surface the costs were as follows:

	Per sq. ft.
Excavation (7 ft. average cut)	$0.0819
Refill on cover (2 ft. deep) and backing walls	0.0293
Groined arch floor	0.1518
Wall cost, distributed	0.0459
Cover	0.2462
Total	$0.5551

*Constructing Engineer, Indianapolis, Ind., Water Co.

COSTS PER UNIT VALUES.	Per cu. yd.
Excavation by machinery, 15,000 cu. yds.	$0.19
Excavation by teams, 11,000 cu. yds.	0.28
Excavation by machinery and teams, 10,000 cu. yds.	0.22
Refilling [illegible] placing concrete, in floor	0.76
Mixing and placing concrete, in floor	0.61
In walls	0.74
In cover	
COST OF BENDING AND PLACING BARS	**Per ton.**
In floors, 103 tons	4.63
In walls, 25 tons	11.37
In cover, 151 tons	6.46

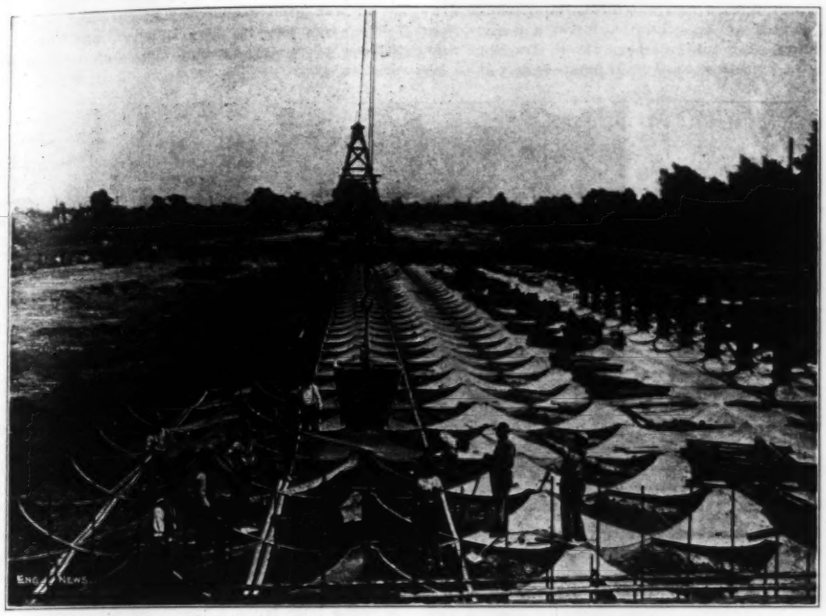


FIG. 2. VIEW OF THE INDIANAPOLIS RESERVOIR DURING CONSTRUCTION.
(Showing Groined Inverted Floor Arches and Column Forms.)

COST OF FORM LABOR	Per. sq. ft.
In floors, 14,800 sq. ft. (ver. surf. panels)	0.03
In walls, 22,600 sq. ft. (wall surface)	0.053
In cover, 145,900 sq. ft. (surface of beams, slab and columns)	0.038

COST OF MATERIALS.

Cement, $1.68 per barrel.
Cold twisted bars, $42 and $44 per ton.
Sand and gravel, $0.20 per cu. yd., being a charge for rehandling gravel taken from the excavation.
Hauling cement and cleaning and sorting sacks, $0.07 per barrel.
Hauling steel bars, $0.80 per ton.

In addition to the above base costs there was an unclassified charge for general construction and miscellaneous material amounting to 6% of the total expenditure for material and labor.

CONSTRUCTION METHODS.—In making the excavation a gravel deposit was encountered about 3 ft. below the surface of the ground. Mechanical tests were made showing that the bank contained 24% voids on an average of all tests and that 52% was retained on a ¼-in. mesh screen and 11% on a 1¼-in. screen, so that it was used in making the concrete. No stones over 2½ ins. were used. All concrete was mixed in the proportion of 1 sack of cement to 6 cu. ft. of bank gravel.

By actual measurement of work done it required 1 1-10 cu. yds. of gravel and 1 1-5 bbls. of cement to make 1 cu. yd. of concrete.

In selecting the gravel care was taken to load from the coarsest deposits, and the bank was so clean that it required no washing.

The equipment for handling concrete consisted of a cableway on trucks, a stationary mixing station and a shuttle car traveling between the mixer and cable tower while the cable was sending out a loaded bucket. (Fig. 3.) A ¾-cu. yd. batch mixer was used, having a super-hopper loaded by cars pulled up an inclined track by a hoisting drum operated by a chain drive. The cars were loaded with 12 cu. ft. of gravel and two sacks of cement before going up the slope. The track was arranged at the super-hopper so that the rear wheels of the car would roll up an outer and steeper track discharging into the hopper. Sufficient water was added in mixing to make a sloppy mixture. For loading the gravel cars, an orange-peel bucket was used which kept a wooden hopper, holding about a cubic yard, constantly filled. The greatest amount of concrete placed in one day was 134 cu. yds., while the average amount for the concreting period was 70 cu. yds.

More than half the excavation, or 15,000 cu. yds., was removed by an excavating machine filling dump cars which were hauled to the dump by a locomotive, moving on an average 240 cu. yds. a day. The balance of the excavation, about 11,000 cu. yds., was removed by wagons and scrapers at the same time. The average progress for the whole work being at the rate of 324 cu. yds. a day.

A large part of the refilling was done by means of a locomotive, excavator and cableway. The dump cars brought the filling to the edge of the reservoir and a long drag operated by the cable engine distributed the fill over the cover.

The quantities involved were: 5,195 cu. yds. of concrete, 283 tons steel bars, 6,300 bbls. cement, 5,700 cu. yds. gravel, 210,000 B. ft. lumber, 26,000 cu. yds. excavation and 10,000 cu. yds. refill.

The work was begun May 8, and was furnished Nov. 27, 1907, since which date the reservoir has been in service.

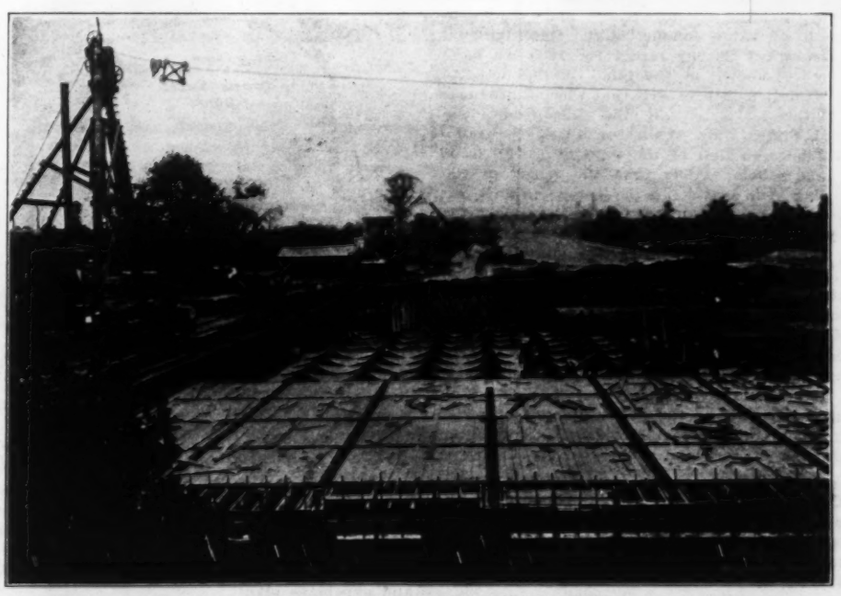


FIG. 3. VIEW SHOWING METHOD OF CONSTRUCTION, INDIANAPOLIS CONCRETE RESERVOIR.

COAL BRIQUETTES are proposed as a substitute for anthracite coal in southern districts, where the cost of the latter for house heating and domestic purposes is prohibitive. The special kind of briquettes will be made from a good grade of Southern soft coal, carefully cleaned, and having a proportion of coke breeze mixed with it. An organic binder of vegetable matter is used, no pitch or tar being employed. The object is to obtain a high grade of fuel that will compete with anthracite under the above conditions. Where the object is to utilize dirty or waste coal that could not otherwise be disposed of, a tar binder is frequently used. In the fire, however, the tar binder melts and the briquettes disintegrates, causing smoke and flame due to the release of larger volumes of volatile matter than can be quickly consumed. The new briquettes are quite hard and retain their shape (in reduced size) even when half burned, so that in this respect they are equivalent to the stove anthracite. Owing to the use of coke breeze, and the fact that the volatile matter in the coal is released in small quantities, the fuel is practically smokeless and burns with little flame. The residuum is a fine ash, with no clinkers.

These briquettes are made by a new type of briquetting machine which is the invention of Mr. Robert M. Hale, who was formerly in charge of the ore-briquetting plant at the South Chicago works of the Illinois Steel Co. This plant was described in our issue of Feb. 12, 1903. The machine consists of a large drum revolving on a horizontal shaft and having in its face recesses forming the molds. There are 32 rows of molds, with 12 in each row, or 384 in all. In line with the horizontal diameter at one side is a charging trough or magazine which is kept full of the prepared material. The material is forced into the molds by plungers. On the opposite side is a horizontal frame or ram which is brought against the molds with considerable pressure, being operated by three eccentrics. As the briquettes have somewhat spherical ends, the entire frame of the pressing apparatus moves back after each stroke to allow the row of finished briquettes to pass this frame as the drum revolves.

At the bottom of the drum (and in its vertical diameter) is a discharging frame which at each stroke pushes a row of 12 briquettes from their molds. The briquettes drop upon a conveyor which carries them into and through a drying oven. The briquettes are 2½ ins. diameter and 1½ ins. thick. The machine can be used, of course, for briquetting a great variety of materials; such as slack coal, iron or copper ore, flue dust and others.

A demonstration of the quality and characteristics of the coal briquettes has been given recently in Chicago. The briquettes and the experimental machine having proved satisfactory, a larger machine is now to be built, having a capacity of 100 tons in a ten-hour day. This will be installed at Birmingham, to make briquettes of local coal for the Southern trade. The new system is owned by the Standard Fuel Co., of Birmingham, Ala., and the intention is to introduce the fuel (which has the trade name of "Anthracoal") in the Birmingham district, where anthracite coal is expensive, as noted above. Mr. Theodore Davis is President and General Manager of the company, and Mr. Robert M. Hale is Vice-President and Engineer.

MODERN LAND-PEBBLE PHOSPHATE-MINING PLANTS IN FLORIDA.

By H. D. MENDENHALL,* Jun. Am. Soc. C. E.

There is a branch of engineering work that has been little mentioned in the technical periodicals of any recent period, and one that is assuming larger and larger proportions in certain parts of the country each year as intensive farming with its consequent intensive fertilization becomes more prevalent. It is the mining of phosphate rock in its various forms, which mining, while not presenting many of the difficulties of some of the other forms, is distinctive and brings up efficiency problems equal to those of any of the others.

As is doubtless well known, it is from phosphate rock that a large part of the world's fertilizer is manufactured. This material is found in various parts of the world, and especially in France, Algeria and the United States. United States phosphate rock is somewhat higher in percentage of tricalcic phosphate than that of the other countries, ranging from about 65% in the river pebble varieties, through 68% to 70% in the land pebble, to 78% to 80% in the hard rock deposits. The volume of output is greater from the United States than that from all of the remainder of the world combined, amounting, according to the report of the U. S. Geological Survey for 1905, to 1,978,345 metric tons against a total of 1,654,437 metric tons reported for the remainder of the world.

In the United States it is found to a greater or less extent in Arkansas, Utah, Wyoming, Idaho, South Carolina, Tennessee and Florida, but it is in the last three only that it occurs in sufficiently large quantities and high grades to make it of value commercially. Quoting from the Geological Survey report for 1905 we have the figures shown in the table on the opposite page, from which it is seen that Florida produces more than 61% of all the output of the United States. By again consulting the table it will be seen that of the total over 44% is of the land-pebble variety, and the report of the following year shows this percentage to have increased to over 51%. A preliminary report for the year 1907, just issued by the Geological Survey, shows that the industry is steadily growing both in amount and value: the total production of phosphate rock in the United States last year amounted to 2,265,343 long tons, valued at $10,653,558. The average price per ton, $4.70, was 58 cents higher than in 1906, an increase of 14%. These figures are based on the market product; the actual quantity mined was 2,356,486 long tons, nearly 60% of the entire amount of phosphate rock coming from Florida. It is with the production of the land-pebble variety that this article will deal.

OCCURRENCE.—Land-pebble phosphate occurs as a stratum of pebble-permeated matrix underlaid with a stratum of tough stiff clayey material known as "bed rock," and overlaid with a stratum of "overburden" varying in thickness from 2 ft. to 28 ft. The overburden is chiefly composed of sand, sandrock, and iron rock, the last two occurring in the form of boulder varying in size from pebble to a cubic foot in volume. The rock-bearing matrix consists of a fine white sand, often of the consistency of quicksand, and varying in thickness of deposit from 1 to 24 ft. The ratio of pebble to matrix averages about 1 to 5 or 20%.

What is known as the Florida land-pebble district covers an area of about 650 square miles, including parts of Hillsboro, Polk, De Soto and Manatee counties, east of Tampa. It is not to be understood, however, that the whole area is underlaid with the phosphate deposit. It is only within this area that any valuable discoveries have been made. Within the district it occurs in beds or pockets varying in extent from a few acres to several hundred. Such pockets are valuable accordingly as they are large in extent, shallow in overburden, high in ratio of rock to matrix, and rich in analysis of phosphates.

OVERBURDEN.—Necessarily the first problem encountered in the opening of a phospate mine is the removal of the overburden. This resolves itself into two distinct forms, depending on whether or not there is a large percentage of boulder in it. Where the prospecting has shown that it is comparatively free from boulder, the hydraulic method is used, and what few sand or iron rock boulders are encountered, are either piled up and left or are hauled away in scrapes or wagons. But when the preliminary examination shows strata or boulder of sand or iron rock to any considerable extent the steam shovel is called into play with its attendant troublesome and expensive plant.

When it has been decided to use the hydraulic method of removal, the first move[illegible] of the first, as all have to be mad[illegible] taneously, is to establish a pump[illegible] the case of the plant of the Pho[illegible] Co., at Nichols, Fla., a 10-in. w[illegible] to a depth of about 400 ft., and a [illegible] 80-HP. Ames horizontal return-t[illegible] with the pumps described later. As large quantities of pine wood [illegible] wood was used exclusively as fuel.

The removal is accomplished [illegible] stream of water against the ban[illegible] draulic giant having nozzles of [illegible]

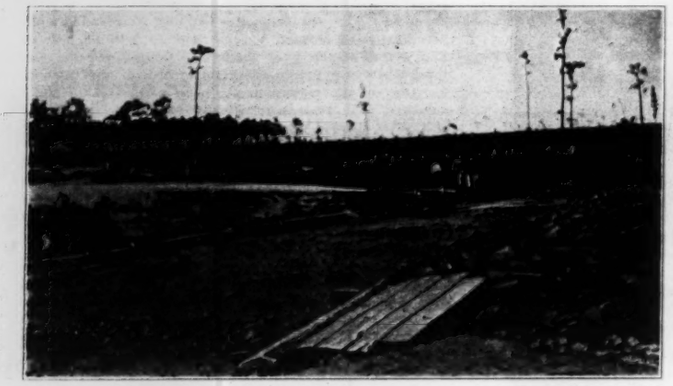


FIG. 1. HYDRAULIC GIANT REMOVING OVERBURDEN.

FIG. 2. REMOVING OVERBURDEN BY STEAM SHOVEL.

2⅛-in. tips, at a pressure averaging about 140 lbs. per sq. in. This disintegrates the material, and the volume of water present keeps the particles in continuous motion, conveying them to a sump hole from which they are again picked up by a powerful centrifugal sand pump and sent to the debris waste bank. At the plant mentioned, the giants were supplied with a Worthington, packed plunger pump for 200 lbs. pressure, with a 10-in. suction and 8-in. discharge, and taking its supply directly from the receiving pool from the artesian well. The centrifugal sand pumps were of the belt-driven type with 10-in. suction and 8-in. discharge.

Frequently the top stratum is found to be so thoroughly packed and baked by the sun that it is difficult to tear it apart, and so in order to facilitate the disintegration of the banks, large quantities of dynamite and powder are used. It is simply charged in rows parallel to the edge of the bank, similar to the method used in quarrying, and all discharged at once, thus loosening and tearing off a slice at each explosion. After this it is in such a form that the giants can easily handle it. Over the deposit in question,

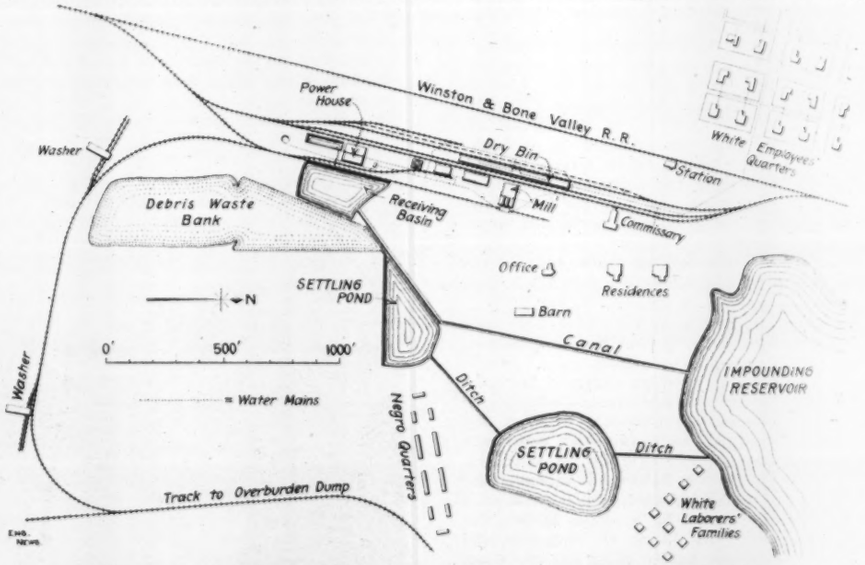


FIG. 3. MAP OF MINING PLANT; MEDULLA PHOSPHATE CO., CHRISTINA, FLA.

*Civil Engineer, Lakeland, Fla.

rock boulders were encountered in small ...tities, and, as before mentioned, were piled ...to one side and subsequently hauled away in ...ons. The hydraulic method, when conditions ...it its use, affords the cheapest and most ex...itious means of overburden removal, but, un...tunately, it can be used but little throughout ... district because of the presence of boulder ...ady mentioned. Fig. 1 shows a giant in ...ion.

...t the plant used as a type in the following ...s, the preliminary prospecting showed too ... a percentage of boulder in the overburden to permit the hydraulic method of removal, so the before-mentioned steam shovels were decided upon. The use of the steam shovel is too common to require detailed description, so only the salient features will be touched upon.

The deposit at this point covers a continuous area of about 80 acres, comprising two adjacent 40-acre divisions of a township. The overburden ranges from 5 to 19 ft., averaging about 12 ft. It was decided to put two mining stations on this area, one in each 40 acres, so two 60-ton Vulcan steam shovels, fired with coal, were installed. The depth of overburden at the point of starting at pit No. 1 in the western forty and skirting around the minable area, averages about 13 ft., necessitating two initial cuts with the shovel to reach the deposit. The removed material must be dumped about a mile away, and as it was desired to work the shovel before the necessary tracks and dump trestle were finished, the shovel was started on an initial cut of about 6 ft. and skirted around the two sides of the property, placing the excavated material in the path of the next cut about two-thirds of the distance, and on the outside for the remainder. This initial cut made a ledge upon which to run the tracks for the overburden trains, and by the time the first cut was finished, all arrangements for receiving the excavated material were perfected and trains began to run. Virtually the same scheme was pursued for mining station No. 2. For the two shovels, there are used four 30-ton saddle-tank locomotives drawing seven 6-yd. dump cars each.

A word might be said in regard to the operation of the dump. A rough trestle, sufficiently strong to hold two loaded cars, is first thrown up. The grade is kept continually upward until the desired height is reached, usually from 20 to 25 ft., after which the trestle is run level to the limit of the dumping ground. When the excavated material has been dumped up to the limit of the trestle, the track is swung laterally and radially off the trestle onto the filled-in embankment using some point low down on the grade as the pivotal point. This produces a fan-shaped embankment the grade upon which at no time exceeds the initial grade of the trestle. A direction for the trestle is usually chosen such that the full length radius can be used from the beginning. This is done to obviate the necessity of building trestle bents on the yielding material of the dump, which would be made necessary by lengthening the radius after the dump is raised.

MINING.—In the mining operations, fortunately unlike the overburden removal, there is but one method, and that the simplest and cheapest known—hydraulicking. Throughout the district the matrix in which is found the pebble phosphate, is composed almost wholly of soft sand, intermixed with a small amount of yellowish white clay easily disintegrated and moved with a hydraulic giant. The method of removal is virtually the same in principle as that for hydraulicking overburden. Usually, however, there is some difference in the distribution of the pumps, due to the added power facilities available by the time actual mining operations are ready to start.

In the dredge-boat method of washing, described later, two 3-stage Morris turbine pumps direct connected to 100-HP. Westinghouse motors

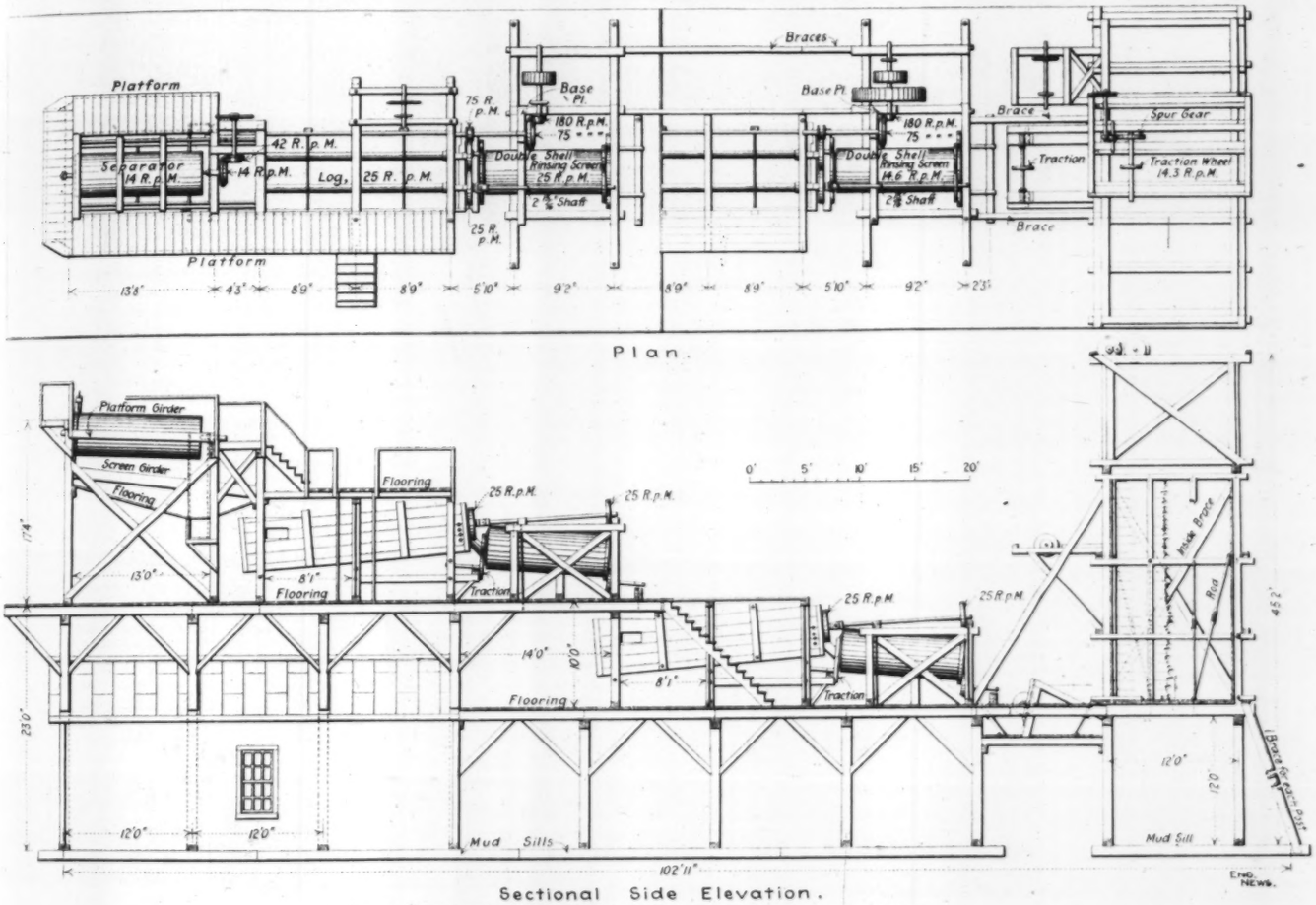


FIG. 4. PLAN AND ELEVATION OF PHOSPHATE MINE WASHER.

PRODUCTION OF PHOSPHATE ROCK IN THE UNITED STATES, 1905-6, BASED ON THE QUANTITY MARKETED.

	1905		Average value per ton.	1906	
	Quantity. (Long tons.)	Value.		Quantity. (Long tons.)	Value.
Florida:					
Hard rock	577,672	$2,993,732	$5.18	587,598	$3,440,276
Land pebble	528,587	1,045,113	1.98	675,444	2,029,202
River pebble	87,847	213,000	2.42	41,463	116,100
Total	1,194,106	$4,251,845	$3.56	1,304,505	$5,585,578
South Carolina:					
Land rock	234,676	$774,447	$3.30	190,180	$711,447
River rock	35,549	103,722	2.92	33,495	105,621
Total	270,225	$878,169	$3.25	223,675	$817,068
Tennessee:					
Brown rock	438,139	$1,509,748	$3.45	510,705	$2,027,917
Blue rock	44,031	121,486	2.76	35,689	114,997
White rock	689	2,155	3.13	1,303	5,077
Total	482,859	$1,633,389	$3.38	547,677	$2,147,991
Other states	.....	.....	....	5,100	$28,800
Grand total	1,947,190	$6,763,403	$3.47	2,080,957	$8,579,437

were employed, each furnishing a 2⅛-in. nozzle with water at 165 lbs. pressure per sq. in. Two hydraulic giants to a pit were usually employed.

By a proper manipulation of the giants, impossible to describe, and only to be gained by experience, small ditches, in which the disintegrated deposit is washed to the sump hole, are kept abreast of the giants. Inasmuch as the particles of matrix are kept in motion purely by the velocity and the volume of the water, it is a matter of no little skill to arrange these ditches so that they will be continuous and still have no point where the velocity will be checked, with its attendant deposition of the suspended matter. Once the matter is in the sump hole, it is taken up by the powerful sand pumps, sent along to similar pumps at the washer and on the same line, and thence up to the washing machinery. The pumps used at the herein described plants were in tandem, both the one at the sump hole and the one at the washer being of the 10-in. suction and 8-in. discharge type, the former with the horizontal discharge, the latter with vertical, and each direct connected to a 100-HP. Westinghouse motor. The motor and pump in the pit at the sump hole is arranged on skids, and protected by a temporary shelter only, so that it can be easily moved to follow the mining operations. The mining operations are continued night and day, those during the night being illuminated with electric arc lights.

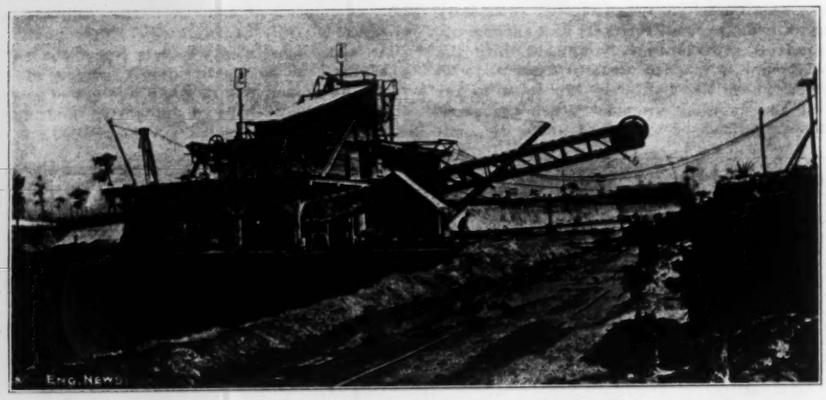


FIG. 5. DREDGE TYPE OF PHOSPHATE WASHER.

By this method of mining each giant can mine on an average about 200 tons of washed rock per 24 hours where the percentage of pebble to matrix is about 20%.

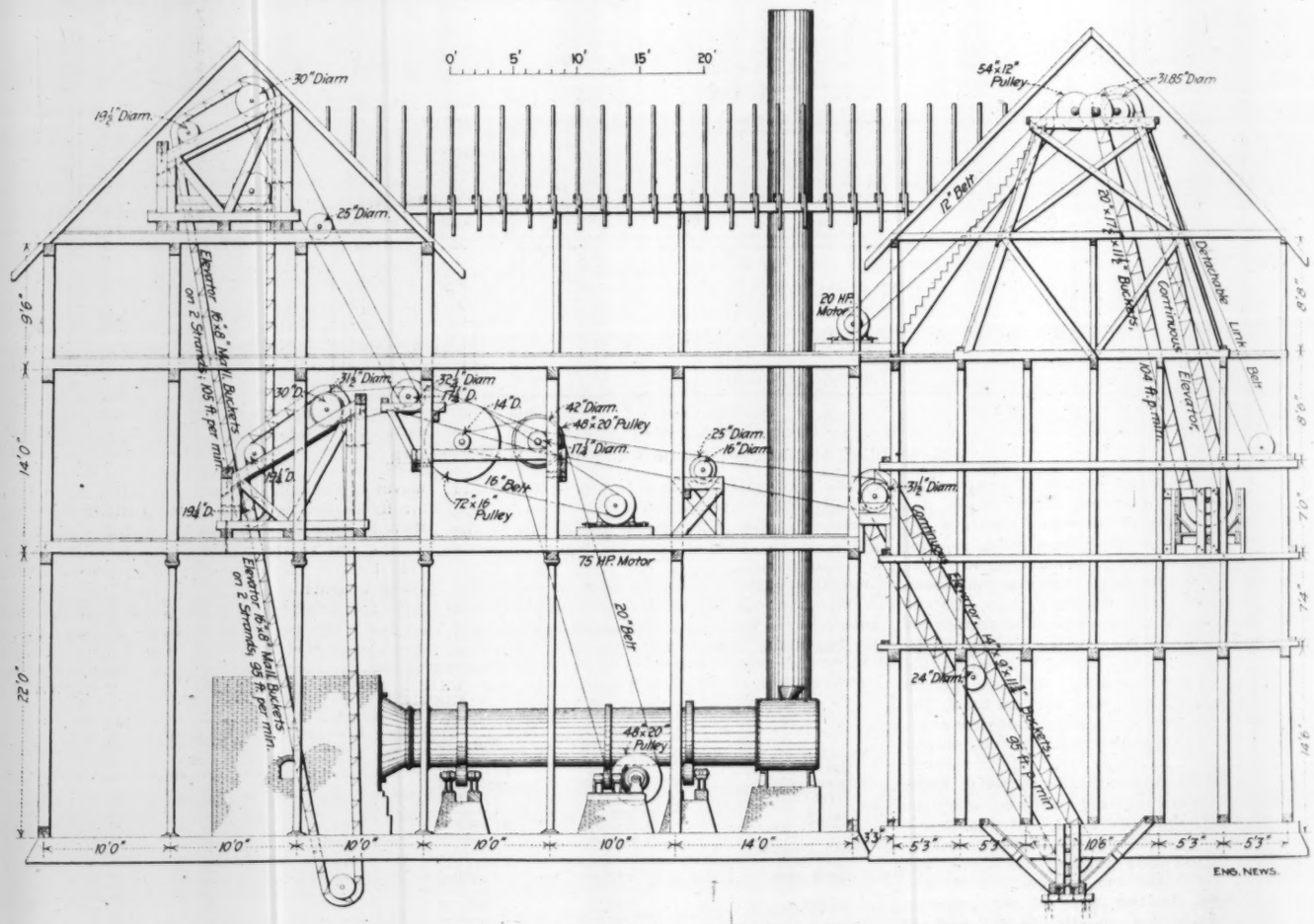


FIG. 6. PHOSPHATE MILL, SHOWING DRYING AND ELEVATING MACHINERY, AND WET BINS.

In the new plant of the Medulla Phosphate Co., the conditions for furnishing the required quantity of water under pressure are especially good. The power-house is centrally located with respect to the entire deposit, being about 1,200 ft. from Washer No. 1 and 2,600 ft. from Washer No. 2, and one central pump located [illegible] it is used to supply the giants. This pump, [illegible] by the Westinghouse Machine Co., is a [illegible]tage double-suction centrifugal type having [illegible] 10-in. suctions with one 15-in. discharge, and [illegible] direct connected to a 450-HP. Westinghouse [illegible]rbine steam turbine operating at 1,800 r. p. m. It is designed to furnish 4,000 gals. of water per min. at 175 lbs. pressure per sq. in. After the discharge pipe reaches the ground level the line is reduced to 14-in. inside diameter. This diameter is maintained for the first 1,200 ft. or to the first washer, and then reduced to [illegible] ins. for the remaining 1,400 ft. to Washer No. 2. Each pit is furnished with a 12-in. branch which divides into two 8-in. branches, one supplying each of the two giants. The central pumping unit, when practicable, is the most economical as well as most convenient arrangement possible, as it permits the use of more highly efficient machinery, such as the steam turbine, together with the additional efficiency raising condensers.

WATER SUPPLY.—Closely related to the mining operations is the water supply system. As can be readily estimated, the supply of water comes to be a considerable item where such large quantities of it are absolutely essential to the mining operations. Of course local conditions, such as proximity to a stream and artesian supply affect the arrangement, and in consequence the variations in arrangement are infinite. This article will confine itself to the arrangement at one plant—that of the Medulla Phosphate, Co., at Christina, Fla.

As has already been mentioned, the estimated quantity of water required for this plant is 4,000 gals. per min. It was originally intended to get the entire supply from artesian wells, but after nearly completing the first one, and finding that excessive depths were necessary, other sources were determined upon to supplement the wells. Two 10-in. wells in all were sunk to depths of

690 ft. and 830 ft., respectively, near the power-house, and found to furnish approximately half the required amount, or 2,000 gals. per min. As the surface of the water stands about 40 ft. below the surface of the ground, an air compressor, described later, has been installed with which to raise the water to the receiving reservoir. To get the remaining 2,000 gals. per min., it was decided to use the circulating method, that is, using the same water over and over. To accomplish this a small dam was first thrown across a small stream which furnishes in all about 200 gals. per min. The contour of the land here is such that the spillway of the dam is at the same elevation as the surface of the receiving reservoir at the power-house, although some 2,000 ft. away. This gives a gravity flow from the impounding reservoir to the central reservoir.

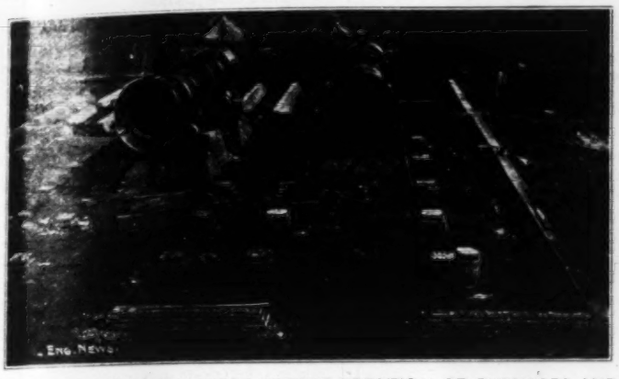


FIG. 7. PHOSPHATE DRYERS BEFORE ERECTION OF FURNACES AND BUILDINGS.

A low-duty belt-driven centrifugal pump, with a capacity of 4,000 gals. per min. against a head of 10 ft., has been installed to be used when the impounded water surface drops below that of the central reservoir. The debris from both washers will be ditched into a depression to the north of the deposit (shown on the accompanying map, Fig. 3), thence into still another depression farther north yet, thence into the impounding reservoir, and thence to the central reservoir as already described. From the washers to the impounding reservoir is a distance of about 3,000 ft., and this, in connection with the 2,000 ft. ditch to the central reservoir makes a total circulation of approximately a mile in which suspended matter is to settle. The flow through the swamp in the reservoir is so retarded by timber and undergrowth that, together with the settling action in the two depressions, it is expected that the water will be virtually clear by the time it returns to the central pump.

Because of the fact that the water supply for the town has to come from the same central point as that for the mines, the central reservoir is divided into two parts. The air compressors lift the water from the wells into a circular tank 30 ft. in diameter by 8 ft. in depth, built of brick and cemented inside. The fire protection pump, which also acts as a city water supply pump, takes its supply directly from this reservoir. A spillway from the reservoir discharges into a second and larger reservoir. This second reservoir is of wood, square, 40 × 160 ft. inside dimensions and 8 ft. deep. It is into this larger reservoir that the muddy circulated water is discharged and from which the large turbine-driven pump and all other pumps necessary for operating the power plant take their supply.

DAM.—The dams necessary for the impounding reservoirs are a simple proposition in this district, because of the low rolling character of the country and the consequent low elevations permissible. The one at the present plant, position of which is shown on the accompanying map, was particularly easy of construction because of the presence of unlimited quantities of material and facilities for handling it. It is of simple earth construction, 25 ft. wide on top, with side slopes of 3 on 2, both sides, and 12 ft. high at the highest point. At the time it was started, the stripping of overburden had already begun, so a switch was thrown off from the supply track shown on the map and a temporary track run directly along the axis of the proposed dam. Then the overburden cars were run out on it and dumped, the track being raised as the filling continued. The whole work of clearing, laying the track, and raising the embankment occupied about two weeks and cost about $250, exclusive of the material, which, of course had to be wasted anyway. No particular effort was made to make it impervious to water other than clearing out all the roots and muck in a ditch 5 ft. wide and an equal depth along the center line. The only consolidating done was that due to the running of the overburden trains over it, the handling of the material by the laborers, and the running of the country road over its crest after its completion. To prevent erosion by rains, Bermuda grass has been planted along the edges and down the slopes. A wooden spillway 12 ft. wide and 2 ft. lower than the crest passes around the southern end as indicated on the map.

This method of dam construction jars on the ideas of those dam-building engineers who are accustomed to the high dams of the west and north where high heads and absolute impermeability are necessary, and so it did on those of the writer when he first saw them, but experience has taught the mining engineers of the district that this simple method of dam construction is all that is necessary, as the dam can be watched continually, its first cost is small and the damage due to a break is of little consequence.

The area submerged as a result of this dam is about 52 acres, and affords an available supply of about 43,000,000 gals., or a total supply of about 60,000,000 gals.

WASHER.—The general design of washers throughout the district is similar, but in details of construction they vary widely. They all maintain the general scheme of pumping the rock-bearing matrix into a separator where the pebble is separated from the clay balls, large sand rocks and other large debris; passing the rocks through log agitators, and finally passing it over or through rinsing screens. But the variations come in the number of sets of logs, number and type of screens, and final method of disposing of the rock.

One of two types has been used on all plants with which the writer has been connected, both the same as regards the washing part, but differing in that one is on a floating structure, or dredge, while the other is on land, or the land type as it is called.

The accompanying drawing, Fig. 4, shows the details of the land type, as installed at the plant of the Medulla Phosphate Co. The matrix is pumped up into the separator by the tandem 10-8-in. centrifugal sand pumps already described, but not shown in the drawings. This separator is a cylinder 12 ft. long by 48 ins. in diameter, punched "hit and miss" with 1-in. round holes. It is inclined on a slope of 1 on 6 and makes about 12 r. p. m. As none of the pebble phosphate rock is of such a size as to be retained by a 1-in. hole, approximately all of the pebble passes through, while the larger clay balls, etc., are retained and worked down into a trough where they are carried off by a stream of water continually supplied from pipes.

The pebble rock is caught on the adjustable screen shown in the drawing, Fig. 4, and washed down into the logs. This screen is 18 ft. long by 6 ft. wide, punched "hit and miss" with 1/16-in. × ½-in. perforations, and inclined on a slope of approximately 1 on 12. It is made with the higher end adjustable in order to accommodate the slope to the various grades of rock. Material such as sand, dirt, etc., that passes through the screen is carried to the same trough that receives the debris from the separator.

The logs in this type of washer are four in number, arranged in pairs. The pairs are identical in arrangement, so a description of one set will suffice for both. They are simply blades or flukes bolted to 8-in. × 18-ft. cast iron pipes, and caused to rotate in opposite directions by means of spur gears, arranged as in the drawing. These gears are on a 6-in. shaft bolted with flange unions to the 8-in. pipe logs. The logs are spaced 36 ins. apart, c. to c., and revolve at 25 r. p. m. The blades are just of sufficient length to miss each other in rotating. The pair of logs are set on an upward incline of 1 on 24 and depend on the pitch of the rotating blades to push the rock forward and into the chutes. The enclosing wooden box is kept full of running water with a discharge opening in the rear. The logs agitate the material, mixing and washing it thoroughly, with the same motion that forces it forward. The debris laden water, as already stated, escapes through an opening in the rear of the logs, and is carried away in troughs.

From the first pair of logs the rock, now partially cleaned, passes into a revolving rinsing screen where it receives a thorough rinsing. This screen is a double cylinder 12 ft. long. The outer shell is 48 ins. in diameter and the inner 36 ins. and both are perforated the same as the flat screen already described, i. e., 1/16-in. × ½-in. They are inclined downward on a slope of 1 on 12 and rotate at 12 r. p. m. Water pipes, perforated in rows so as to distribute the water along the whole length of the screens are run both inside and out. The debris passing through these screens is caught in a wooden trough and carried away. It has been found that, to facilitate the passage of the rock through the screen, it is necessary to introduce flights to assist gravity down the slope.

From the screens the rock falls into another set of logs, the same in every detail as the first, passes from them into another rinsing screen the same as the last, and thence into the receiving hopper.

From the receiving hopper the now thoroughly cleaned rock has two routes which it may follow. When cars are available they are run under the hopper and the rock is discharged directly into them through a gate in the bottom. In case, however, there is a delay in getting the cars spotted, an elevator, driven by a friction clutch from the main driving shaft, delivers the rock into a bin joining the washer. Cars may then be run under this bin and loaded through bottom gates.

Fig. 4 shows a washer of the "Dredge" type. The machinery down to the discharge of the rock from the last screen is the same as for the land washer already described. But in place of having the whole machine stationary, it is constructed on a barge and the conveyor shown in the cut transfers the washed rock from the receiving hopper to the cars on shore. This conveyor is an entirely independent machine, on a separate barge, and driven by a separate motor. The advantage of this type of washer is that as a pit is mined out, water may be admitted into it and the washer made to follow up the operations. A dam of sufficient width to hold the head of water is left between the exhausted pit and the new operations. This method has the advantage of giving a minimum lift to the mining pumps and a minimum distance of transmission of the material. There seems to be no well-defined objection to it other than the danger of the dam breaking, and the natural antipathy a land man has to the apparently unstable barge in the water.

MILL.—From the washing plant the rock goes to the central wet storage and drying plant, combined under the name "Mill." Fig. 6 shows the wet storage bins and the drying and elevating machinery. The washed rock is usually run up on an elevated track and discharged into a receiving hopper back of the wet bins. It goes from here into elevator boots, whence it is taken by the elevators up into the wet bins. The

hopper and lower flight of elevators are not shown on the drawing.

The three bins at the mill have a total capacity of 1,100 tons of wet rock.

The rock is drawn from the bins by chutes leading to another elevator boot, whence it is elevated to another hopper that feeds directly into the two dryers. Both the outer and the inner wet elevators are of continuous type, having steel buckets fastened to No. 847 Ley bushed chain running over traction wheels and having a capacity of 50 tons per hour running at 100 ft. per min. Because of the difficulty in repairing breaks and the increased size of head shaft made necessary by long flights of elevators, the outer flight is made in two stages of approximately 35 ft. each.

The dryers are of the revolving cylinder type with diaphrams, flights, and showering shelves similar to, though smaller than, the ones used in cement manufacturing. The side elevation shown in the drawing, Fig. 6, gives a good idea of their arrangement. They are 30 ft. long by 52 ins. inside diam., and make 10 r. p. m. They are fed from the cold or smoke-box end, and discharge the rock from a flare end just outside the furnace. This type of dryer has a capacity of about 150 tons per 12 hours and is manufactured from detail drawings furnished by Mr. C. G. Memminger, Consulting Mining Engineer, Lakeland, Fla., the designer of the plants under discussion.

The furnaces have no features out of the ordinary other than that they are designed to burn oil, coal, or wood, by making simple changes requiring not more than an hour's delay at most. Fig. 7 shows the dryers as they appeared before the building was erected around them and the furnaces built.

From the dryers the now thoroughly dried rock passes through chutes to a concrete boot whence it is elevated in two flights to the top floor and discharged into a conveyor to be taken to the dry storage bin. These elevators are a little different in type from the wet elevators, being malleable "A" buckets suspended between two strands of No. 124 Ewart detachable link belting and passing over head and knuckle sprockets to insure perfect discharge. As the rock is sometimes red hot when it issues from the dryers, everything connected with the elevators such as the boots, chutes, etc., must be fireproof. This is effected for the boot by making it of concrete, and by using nothing but sheet iron chutes, sheathing all timbers and adjacent flooring with sheet iron, and having the boot on the second floor of wrought iron.

The conveyor that carries the dry rock across from the mill to the dry bin, is the pan type, running on self-oiling rollers and driven by a 10-HP. motor from its head. It is 66 ft. c. to c. of end shafts, and has a capacity of 50 tons per hour.

The driving apparatus for the mill machinery is very simple. A 75-HP. motor making 580 r. p m. drives, by a belt, a jack shaft making 150 r. p. m. This in turn drives, by means of a Renold roller chain, a line shaft making 50 r. p. m. A Ewart sprocket attached to a friction clutch drives to a counter which in turn drives the head of the inside wet elevator. Another sprocket similarly arranged drives a counter which in turn drives from one sprocket the lower dry elevator, and from another a counter leading to the upper dry elevator head. A pulley on the line shaft drives a similar pulley on the ground floor from which both dryers are driven. Jaw clutches on the driving shaft make it possible to throw either or both dryers on or off at a moment's notice. The head of the outer wet rock elevator and that of the dry rock conveyor already noted, are driven by independent motors, the elevator by a 20-HP. and the conveyor by a 10-HP. This is done in order that either apparatus may be run independently of the mill.

The structure of the wet bins is of wood, with corrugated iron roofing. There are three of them, each 31 ft. 6 ins. long c. to c. of outer posts, the two outer ones 19 ft. 7 ins. wide c. to c. of outer posts, and the center one 12 ft. 2 ins. The supporting structure is of 10 × 10-in. timbers on brick wall foundations, the bin posts and purlines are of 6 × 8-in. and 8 × 8-in. timbers, and the superstructure is of 6 × 6-in. timbers. The bin proper is floored with 4-in. timber and sided with 3-in. and 2-in. Lateral stresses are taken up by iron rods running lengthwise and crosswise. Stresses are computed for wet rock on the assumption that it weighs 90 lbs. per cu. ft., with an angle of repose of 33°.

The mill building is also framed of 10 × 10-in., timbers, sided with sheet iron and covered with corrugated galvanized iron. It is 64 ft. square, two stories high for 34 ft of its length and four stories for the remaining 30 ft. On the bottom floor are the dryers, second the driving machinery and on the fourth the head of the dry elevator and the foot shaft end of the pan conveyor. The third is simply an intermediate floor used for sampling or any other minor uses that might arise.

DRY BIN.—After the rock has been thoroughly washed and dried, nothing remains for it but shipment.

As already described, the dry rock is carried from the mill elevators to the dry bin by a pan conveyor. This conveyor discharges into a sheet iron hopper holding about three tons. Tracks run along both sides of the bin converging at the center and immediately beneath the hopper on a scale platform. One ton side-dump cars are run on the platform, the hopper gate opened, and the rock allowed to run in until the automatic buzzer announces that a ton has run in. Then the ever present "nigger" finishes the job by pushing the car to the proper place and discharging it. Here the rock rests until it is shipped. The bin construction presents no complications. The standard width used in these plants is 30 ft. c. to c. of outer posts, with a capacity of 25 tons per lin. ft., or 12,500 tons for the 500-ft. bin. The supporting structure is built of 10 × 10-in. pine posts spaced 5 ft. c. to c. each way and resting on continuous brick foundations running lengthwise of the bin. In order to load a box car standing alongside, the floor of the bin proper is made 16 ft. above the top of the brickwork, and the chutes put in every 5 ft. to run rock into the cars.

The floor is built of 4-in. timber covered with No. 26 black sheet iron. The sides are stiffened with 8 × 10 posts every 5 ft. with 4 × 10 studs half way between and all stiffened by two rows of 8 × 10 and one row of 6 × 10 purlines running lengthwise of the bin. The sides are built of 3-in. timber for two-thirds of the distance up and 2-in. for the remainder and lined with No. 26 black sheet iron the same as the bottom. From the bottom of the flooring to the top of the roof plate is 24 ft. Lateral stresses are resisted with round iron rods running across the bin and through the purlines on each side. The overturning stresses caused by the rock being drawn from half of the bin at one time are resisted by diagonal rods running through the top purlines and down to the center, passing through the supporting structure bent cap. The cross rods are in three vertical rows to correspond to the three rows of purlines and are spaced 10 ft. apart horizontally. The diagonal rods are put in every intermediate 10 ft. The end walls are braced with three rows of diagonal rods spaced 10 ft. apart horizontally.

Stresses in these walls are computed on the assumption of 80 lbs. per cu. ft. for the dry rock with an angle of repose of 30° and a coefficient of friction on sheet iron of 0.6.

The roof is covered with No. 26 corrugated galvanized iron on 2 × 6-in. rafters.

POWER-HOUSE.—In the styles of power plants in the district there is found a wide divergence, but the majority of the plants making any pretense to high efficiency depend upon a central electrical plant and use motors for driving the various machines. It has been the rule to make installations such that dependence will have to be put on no one class of fuel, and in order to do this steam has been used entirely as a generating force. Until late years, wood has been the cheapest and most p[illegible]ful of any of the present fuels. But gradua[illegible] has become scarcer as the forests have [illegible]denuded, and coal and oil have come into [illegible]. In a district so far from the source of s[illegible] of either coal or oil, it has been deemed dan[illegible]us to have to depend on any one fuel.

In the present plant three 40[illegible]P. Stirling water tube boilers are installed [illegible] furnaces arranged to burn, as already sta[illegible] either oil, coal or wood. Room has been le[illegible] a fourth boiler when future extensions de[illegible] it. Two 500-KW. and one 450-HP. Wes[illegible]house-Par[illegible]sons steam turbines are used as [illegible]ne movers, the first two direct connected t[illegible]-KW. 3-phase alternating current genera[illegible] and the third to the central centrifugal p[illegible]ure pump already mentioned. A 25-KW. [illegible]ct-current Westinghouse generator direct co[illegible]ected to a 6 × 7 and 7½ × 7 steam engine [illegible]sed as the primary exciter set and as a secon[illegible] set there is a motor-driven generator of th[illegible]ame electrical dimensions.

All of the turbines are run conde[illegible]g and for this a special suction arrangement [illegible] made for the pump. An Admiralty type surf[illegible] condenser is so installed that the suction o[illegible] the mining pump draws its water through the condenser. This obviates the necessity of a separate pump of the necessary capacity.

In case, however, it is necessary to cut out the condenser for any reason, by passes are put in and operated by gate valves so that water can be taken directly from the reservoir. In case it becomes necessary to operate the condenser without running the mining pump, an engine-driven centrifugal pump with 10-in. suction and 8-in. discharge connects with the intake of the condenser and can furnish the required water for condensing. The condenser is also furnished with the necessary 10-in. discharge to the reservoir. The condensed steam and admitted air is drawn out by a 8 × 20 × 12 single Edward's air pump discharging into the hot well.

The air compressor is an Ingersoll-Rand Co.'s 16-in. and 28-in. × 18-in. steam and 18¼-in. × 18-in. air, class "G" type. This machine furnishes 1,249 cu. ft. of air per min. and is used to lift the water from the two 10 in. wells already mentioned.

EMPLOYEES' QUARTERS.—As all, or nearly all, of the plants in this district are located some distance from a town, the proper housing of the employees becomes a decidedly important and expensive item. In this case the nearest town of any size is Lakeland, eight miles away, and so an entire village had to be built complete.

FIRE PROTECTION.—As may be readily supposed, full fire protection is installed covering the entire plant and town, which protection also furnishes the necessary water supply. An 18-in. × 10-in. × 12-in. Worthington underwriters' fire pump, with a capacity of 1,000 gals. per min. and having a 10-in. suction and 8-in. discharge is placed 50 ft. from the boiler room of the power-house, from whence it derives its steam. It is kept in commission all the time. It takes its supply from the receiving reservoir of the artesian well and, in daily use, simply fills the tank. The tank is of 20,000 gallons capacity on a 100-ft. tower with an 8-in. uptake pipe. A 6-in. main circles the plant and furnishes the fire plugs. Branches from this main run into all of the buildings, including the dry bin. At convenient corners 2½-in. home-made fire hydrants are put in with 500 ft. of 1¼-in. hose near at hand. The map, Fig. 3, gives a plan of the water supply system.

CONCLUSION.—This finishes the rough sketch of a modern phosphate mining plant. When it is considered that in the land pebble district alone there are some 20 such plants, each turning out from fifty thousand to half a million tons a year, it can be seen that an important industry is quietly working in this end of the country.

All possible credit and thanks are hereby given Mr. C. G. Memminger, Consulting Mining Engineer, Lakeland, Fla., for the drawings contained herein. It is a plant of his design that has just been described.

PERMA... UNDERPINNING FOR THE PARIS SUBWAY OF THE PARIS & ORLEANS RY.

Or... lines of the Metropolitan Ry. of Par... ass beneath the underground line of the P... Orleans Ry., near the Pont St. Michel brid... the Seine. The section of the Metro- pol... which forms the crossing is about 197... length, between two shafts sunk by the ...atic process, one of these being in the riv... crossing is at an angle of about 40°, an... ails of the Metropolitan Ry. will be ab... ft. below those of the other road.

...is & Orleans Ry. occupies a subway in... which forms the river bank. It has ve... masonry walls and a flat roof having tra... girders with longitudinal I-beams and ja... bes. The masonry invert is but little abo... level of the surface of the river, and the inv... and walls rest upon a bed of sand about 13... thick. The engineers of the Metropolitan Ry. proposed to use the freezing process to form a solid shell between the two shafts, and to excav... the tunnel within this shell by ordinary methods. The engineers of the other railway, however, were apprehensive of trouble and possible damage to that line, especially in view of the character of the material underlying their structure.

Under these circumstances it was considered necessary to carry the subway of the Paris & Orleans Ry. on a foundation which would render it independent of any movement of the soil which might be produced by the construction of the Metropolitan Ry. tunnel beneath it. It was also decided that this work must be done before the commencement of work upon that tunnel. The work may be divided into two parts, as follows:

(1) The construction of two masonry arches under the quay (and parallel with the subway). These are on each side of the subway, and span the location for the tunnel. They are founded on piers sunk to a foundation below the level of the invert of the Metropolitan Ry. These arches are to carry the quay independently of the underlying material through which the tunnel will be driven. The piers of the arch on the land side also have to resist any lateral pressure due to sliding of that material. (2) The construction of steel girders and a metal floor system for the Paris & Orleans Ry. subway, the metal to be embedded in concrete. The girders are supported by eight piers sunk to the same level as those for the arches mentioned above.

The general arrangement of the work for supporting the subway is shown in the sketch plan, Fig. 1. There are eight piers of oval section, A, A, which were sunk by the pneumatic system. These carry four longitudinal girder spans B, B, the diagonally opposite ends being supported on the old masonry, as shown at C, C. The shorter spans (36.5 ft. to 38 ft.) have single plate girders 4 ft. deep. The span of 63.3 ft., crossing the location of the new tunnel, has doub'e lines of girders of the same depth; these

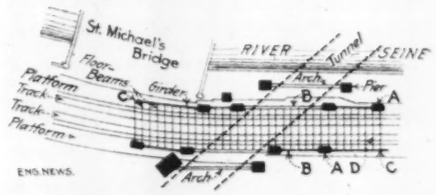


Fig. 1. Plan of Piers and Girders for Underpinning the Subway of the Paris & Orleans Ry. Over the Tunnel of the Metropolitan Ry. at Paris, France. (This plan is below the roof of the subway.)

be done which would involve the cutting of track, and the work on the track could be done only between 12.50 and 4.15 a. m.

The caissons for the 13 piers were sunk to about 40 ft. below the rail level of the subway. The two arches parallel with the subway (and rising only a little above its rail level) have a clear span of 54 ft. They are built of stone, laid in Portland cement.

The old invert of the subway had to be removed entirely. This work was done in the short time during which there was no traffic.

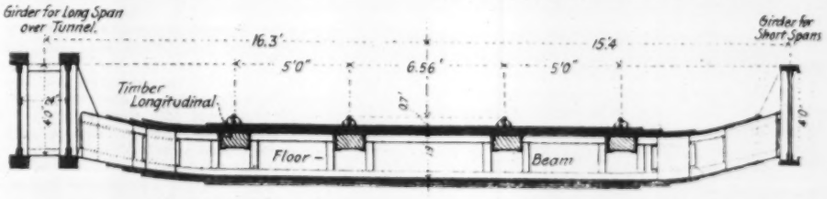


FIG. 2. GIRDERS AND FLOORBEAMS OF UNDERPINNING.

The line is operated by electric locomotives, taking current from a third-rail system, but an overhead wire system was substituted for this temporarily.

As soon as traffic ceased, an 18-ft. length of track was taken up, and the ballast removed to expose the invert. Timber longitudinals were then placed on the invert, and the cross-ties of the track replaced upon these longitudinals. During the day (in the intervals between trains) workmen with pneumatic drills bored blast holes about 30 ins. apart. At night, the track was again removed and the invert was broken up by charges of Favier powder. The track was again replaced, on ballast laid upon the debris. The masonry walls and the walls carrying the station platforms were blasted away

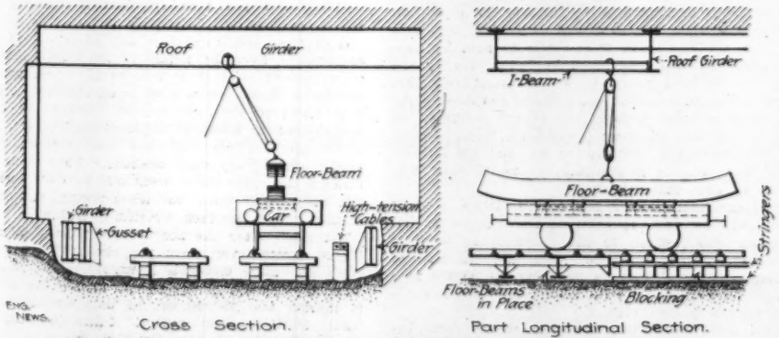


FIG. 3. UNLOADING FLOORBEAMS IN SUBWAY; PARIS & ORLEANS RY.

are connected by diaphragms so as to form one single heavy girder. This arrangement is shown in Fig. 2, which also shows the cross girders or floor beams, D. These are so shaped as to occupy the position of the old invert, and they are embedded in concrete. They are spaced 12 ft. apart, and between them are steel stringers carrying timber longitudinals for the rails. The floor system is completely embedded in concrete, and a drain is formed in the concrete beneath the cross girders.

The special difficulty of the work lay in the necessity of avoiding all interruption with a traffic which averaged 240 train or engine movements in the subway during a period of 21 hours per day. During this time no work could

(to make room for the longitudinal girders), the charges being fired in the intervals between trains. Centrifugal pumps driven by electric motors were used to remove the water coming in after the destruction of the invert.

The new steel work was delivered by work trains which ran after regular traffic had stopped. At each end of a girder was set a timber trestle consisting of two A-frames connected by a transverse timber spanning the car. Tackle attached to the beam was used to raise the girder sufficiently to allow of thrusting under it an I-beam whose ends rested upon screw jacks seated in the A-frames. The girder being raised and supported by the jacks, the train was then moved away, and the girder lowered by the jacks and blocking. Finally it was slid laterally into place upon the cast-steel shoes on the tops of the piers.

To place the floor beams, it was necessary to remove the ballast and the debris of the old invert to a depth of 3.28 ft. below the rails. One track was taken up for a length of 32.8 ft. and the ballast and broken masonry rapidly loaded into a train on the other track. The track was then replaced, with its ties resting on longitudinals each composed of two lines of pine stringers 10 to 13 ft. long, with blocking between them (Fig. 3). The track was surfaced by ballasting and tamping beneath the bottom stringer.

At the location for a floor beam, a longitudinal I-beam was placed resting on the bottom flanges of two adjacent roof girders. To this was attached a hoisting tackle, as in Fig. 3. The floor beam was raised from the car, and the train hauled away. The track and the timber longitudinals were then removed. The floor beam was lowered, turned transversely, and adjusted in position for riveting its ends to the gusset plates of the longitudinal girders. The steel stringers were then laid, the timber longitudinals fitted between these, and the track ties replaced finally upon these latter.

Under the St. Michael's bridge, the roof construction did not permit the use of the overhead lifting beam for the tackle. A special traveling crane was rigged up temporarily for use at this point. It was a four-wheel flat car, having a horizontal boom about 30 ft. long and 3 ft. above the floor. This was pivoted at the rear of the car, and had a sliding support under the hoisting gear, which was mounted on the boom, forward of the pivot. This crane was run on the track opposite to that occupied by the car carrying the floor beam.

It will be noted that the track is laid with double-head rails carried in cast-iron chairs attached to the ties. It would have been impracticable to remove and replace the rails and chairs each time, and therefore the track had to be handled in complete sections. The work was complicated by the necessary precautions to prevent injury to the high-tension electric cables.

The floor beams were set at the average rate of two per night. Following the erection of the steel work, the concrete floor was placed, enveloping the floor beams and having within it a bottom drain. Vertical cast-iron pipes are embedded in the concrete at intervals of 10 ft. After the Metropolitan Ry. tunnel has been built, cement grout will be pumped through these pipes so as to fill any voids under the subway invert due to the settlement of material resulting from the tunnel works.

In spite of the numerous difficulties the work was successfully completed between January and August, 1907. It was done without any accident, and without injury to any of the men. The only interference with traffic was the reduced speed of trains past the work, and in some cases a temporary reduction in the length of the station platforms. These results are attributed to the excellent organization of the work and the working gangs, and to the definite instructions given by the engineer in charge as to the work of each day and each night. The total cost was about

$170,000, of which more than $20,000 was for drainage.

The particulars given above are taken from a paper in the August number of the "Revue Generale des Chemins de Fer" by Mr. Jegou d'Herbeline, Chief Engineer of Maintenance-of-Way of the Paris & Orleans Ry.

THE STORY OF A REMARKABLE PROPAGANDA.

The shibboleth of "Good Roads" in its time caused a good deal of excitement all over the United States. It furnished an excellent theme to various enthusiasts, and made a most useful talking-point for politicians, besides serving various private or partisan interests. But at the same time it did a very great amount of harm, partly by producing much misdirected effort, and partly by checking progress in other directions. Prof. Ira O. Baker in a recent discussion on "The Maintenance of Macadam and Other Roads" before the American Society of Civil Engineers has pictured in forcible manner the nature of the agitation and its injurious result in paralyzing the work of improving the earth roads of the Mississippi Valley. We reproduce this portion of Prof. Baker's remarks below, from the society's "Proceedings" for September, 1908, p. 998.

The author's remarks are inspired in part by the fact that many of the Mississippi Valley states, regions of high productivity, are restricted to earth roads by their total lack of hard road-building materials. The solution of the complex and difficult problem of caring for and improving the roads in these regions has made steady but slow progress. During the height of the "good roads" craze, however, the extravagant booming of macadam for all and every region discouraged study of and expenditure for earth roads, and correspondingly set back the development of the country roads in these states. Prof. Baker said, in part:

During the ten-year period beginning about 20 years ago a large amount of literature upon the subject of rural road improvement was set afloat in newspapers, magazines, and reports, and, because of this flood, the wagon roads of the country districts have made less progress in the last 15 or 20 years than any other phase of rural life.

THE METHODS OF THE PROPAGANDA.—About 20 years ago, two or three well-organized manufacturing interests, in order to increase the sale of their goods, deliberately started an agitation for better roads, and, unfortunately, committed the conduct of the scheme to those who knew little or nothing about either road construction or the larger principles of economics and political action involved in any comprehensive system of road improvement. The interests back of this propaganda were very skilful in arousing the enthusiasm of their followers, who were both numerous and widely distributed, and an attempt was made to carry by storm a reform system of constructing and maintaining the wagon roads of the nation. Many politicians and newspapers sought to secure popularity by favoring the proposed reformation, and, as a consequence, wide circulation was given to certain facts and theories which in their proper field were true but which when presented without limitation were wholly false and entirely misleading.

These intemperate advocates of road reform frequently cited the wagon roads of England, France and Switzerland as examples of what the United States could and should do, regardless of the fact that those countries are abundantly supplied with good road-building materials, while in this country there are areas, greater than the combined area of those countries, in which there is absolutely no road-building material. Again, the stone wagon roads in those countries were built under the stimulus of military necessity and commercial need, before the advent of steam railroads; while in the greater part of this country the railroads have been the pioneers, and now there is no commercial need of long lines of wagon transportation, except perhaps in the immediate vicinity of large cities. Further, the density of population, the industrial occupation, and the agricultural methods in those countries are very different from the methods prevailing in this. Still again, the method of maintaining wagon roads in those countries, with their dense and poorly-paid population, is no criterion by which to judge what is wise or possible in this country. And once more, the political and social ideals on the two sides of the Atlantic are very different, and make possible certain results in Europe which are impossible in the United States.

Again, these enthusiasts frequently cite the experience of local cities on Long Island and in New Jersey, within a few miles of New York City, as though they were representative of rural conditions in general. New York is the largest and wealthiest city on the North American continent, and it is not to be wondered at that the building of good roads is one means of enticing people to move from the densely populated districts of the city into the more healthful suburban regions, and that the influx of such inhabitants has greatly increased the value of real estate; but not all of the United States is situated in the bedroom of New York City.

Some years ago the annual report of the State Highway Commissioners of New Jersey contained an interesting account of road improvement in Gloucester County, which has been very widely copied and commended; but when it is known that this country is just across the river from Philadelphia, and that the soil is very sandy and the road improvement simply enabled truck farmers to wagon their produce to market, it is seen that this example has but little practical bearing on the general question of rural road improvement.

Again, along the eastern shore of New Jersey there is a continuous line of summer resorts, where people of wealth go to enjoy themselves, and it is doubtless a good business proposition for such communities to build first-class stone roads for the pleasure of their profitable guests; but their success does not prove that a truly rural community should follow their example and also build expensive roads.

The examples of the States of Massachusetts and New York in hard-road building are frequently commended to the inhabitants of the Prairie States of the Mississippi Valley, but the industrial and topographic conditions of these two States are not guides for the flat grain-raising States. The primary fault of most road reformers has been that, through dense ignorance, superficial knowledge, or deliberate intention, they have presented facts separate and apart from their limitive conditions, in such a way that the truth becomes a falsehood.

ITS HARMFUL EFFECTS.—This ill-advised and intemperate road agitation has in many cases done harm in the communities most needing road improvement, since a form of road construction has been advocated which, under most conditions, has been entirely impracticable, if not ridiculous; and the result has been that those who are most interested in good roads have been most concerned to prevent road construction and maintenance being made subservient to interests foreign to those who use the roads most and also pay for them; and, as a result of this condition of affairs, the improvement of local roads has not received the attention recently that its importance warrants, and has not kept pace during the past 20 years with rural development in other lines.

Furthermore, all these road enthusiasts claimed that the only good road was a hard road; they were also very vehement in the assertion that nothing could be done to improve the earth road. In many localities a hard road was politically and economically impossible, and hence the earth road was the only form available; but the assertions of the good-road enthusiasts only serve to fix the belief that nothing could be done to improve the roads of such localities.

ITS FALLACIOUS ARGUMENTS.—It was in the field of economics that these road reformers made their most glaring errors, produced the most irritation, and aroused the most antagonism. In this field the farmer was most capable of independent judgment. He was not much concerned about the lessons which the road enthusiast sought to draw from European experience or even from experience along the Atlantic Coast, for the farmer knew that social and industrial conditions in those localities were very different from those in the Mississippi Valley, and hence such arguments made little or no impression on him; but when the hard-road enthusiast began to tell the farmer how much it cost him to haul his produce to market, and how much he could save by the construction of hard roads, he knew instinctively that the conclusions were ridiculous, and the continual harping upon these false statistics and absurd estimates led him to believe that an attempt was being made to force hard roads upon him, whether or no, and his attitude changed from one of indifference to one of open hostility to all road improvement.

A brief examination of a few of the claims of these agitators will be made in order to see whether or not the farmer was justified in his judgment as to their truthfulness. It would not be worth while to refer to this literature except that by so doing its nature may be exposed and thus prevent it from being used in similar discussions in the future.

THREE SPECIMEN TRACTS.—The speaker will examine three articles—of the most reputable parentage—which have been most widely circulated in their original form, and are most frequently quoted. These articles seem to have been distributed to all the public libraries, and, apparently, when any one is moved to prepare a speech on road improvement or write an article on that subject to be used as plate matter in the country newspapers, he consults such literature. The speaker has seen evidence that each of the articles about to be referred to was used recently in connection with the meetings called to secure a good-roads pl[illegible] in the platforms of the two principal political pa[illegible]

1. One of these articles is a 64-p[illegible] pamphlet entitled: "The Gospel of Good Roads, [illegible] letter to the American Farmer," published by The [illegible] of Ameri-can Wheelmen. The author says:

> From official Government sources I fi[illegible] the farmers of this country, in the year 190[illegible] upon their farms draft animals as follows:
>
> | Kind. | Number. | Value. |
> |---|---|---|
> | Horses | 14,213,837 | $[illegible] |
> | Mules | 2,331,027 | [illegible] |
> | Oxen | 36,849,024 | [illegible] |
> | Total | 53,849,888 | [illegible] |
>
> You see you have nearly $2,000,000,000 [illegible] sted in motive power of a perishable, uncertain [illegible] expensive kind. Busy or idle, these animals m[illegible] be fed and cared for every day. They are boarder[illegible] you can't get rid of when the busy season is over, [illegible] and it stands you in hand to keep them at work.

The author of the above had surely not [illegible] traveled much, or he would have learned that there wer[illegible] not anything like two and one-quarter times as many [illegible] oxen in this country as horses and mules. Evidently, [illegible] where the census report said cattle, he read oxen! [illegible] man refers to a fellow hard-road enthusiast who "[illegible]estimates" that "bad roads cost the farmer $15 per year for each horse and mule;" and calculates that this [illegible] amounts to $250,000,000 per annum. He next asserts, apparently offhand, that the loss due to "wear and tear on wagons and harness is $100,000,000." He then proceeds to add together the value of his draft animals, the alleged cost of bad roads, and the estimated cost of wear and tear on wagons and harness, and gets a total of $2,350,000,000. The sum is frequently quoted as the annual cost of bad roads in this country.

The above computations are almost as good as anything in "Puck." Were not some of the horses and mules utilized in the cities? Think of the ludicrousness of including the value of each horse and mule in the cities (including those then used on the street railroads) plus $15 in determining the cost to the farmer of bad roads. Isn't it cruelty to animals to make the colt in the farmer's pasture bear the burden of a draft animal; or to charge the maverick on the plains with being responsible for part of the cost of bad roads? The wear and tear on wagons and harness had already been included in the preceding $250,000,000, the cost of bad roads; but an extra $100,000,000 is nothing to a hard-road enthusiast. Of course it is a small matter to have added the value of the draft animal to the alleged difference of its earning power on good roads over that on bad roads! The article makes an error of $2,100,000 in determining $250,000 or less! But such an error is of no moment to the road reformer!

There are several other things in this pamphlet almost as misleading, but the foregoing item is referred to here because it is the part most frequently quoted.

The pamphlet is liberally illustrated by cuts made from prize photographs collected by the members of the League, showing the impassable condition of earth roads, and also by cuts of some of the magnificent roads of Europe. As well show a picture of some of the hovels on the rocks on the north end of Manhattan Island or of a 46-story building, as representative buildings of New York City.

2. The article which has been quoted most frequently is one published by the United States Government, in which it is distinctly stated that the cost of wagon transportation in 1895 was $946,314,665.54 and that the possible annual saving by road improvement is $628,000,000. This article also distinctly asserts that the cost of hauling the farm crops to market is $982,000,000, or 26.6% of their value.

This report has been criticized in detail elsewhere, and hence needs no further examination here. With a certain class this conclusion had great influence, as it appeared to have the weight of the United States Government, and as it claimed to be the result obtained in answer to 10,000 letters sent to agricultural correspondents all over the country; but farmers of the rich grain-producing areas of the Mississippi Valley, the districts most in need of road improvement, protested loudly against any such estimate. They claimed that, through the exchange of work and by doing their hauling when other work was not pressing, the marketing of their crops cost them practically nothing.

Ten years after the above report was published, the United States Government published the results of another and more elaborate investigation, in which it is distinctly stated that the cost of hauling the 1905 crops to market was $84,684,000, or only one-eighth of the result in the former report! Other Government statistics show that the crops of 1905, the year of the last report, were practically twice as large as those of 1895, the year of the first report; and therefore the result by the later and more elaborate investigation is really only one-sixteenth of that of the first report! In other words, the result by the first report is virtually admitted to have been sixteen times too large! Is it any wonder that the farmer was unwilling to accept such a result?

As illustrating the fatality that seems to overtake hard-road enthusiasts when they attempt to compute the

...of bad roads, or rather as illustrating their prone... to look for excuses for making their results larger, ...ct may be mentioned that in the latter investiga... the author added $11,700,000 for the wheat that was ...d from the farm to the mill, which by his own ... is equivalent to saying that nearly one-third of ... wheat raised in this country is hauled in wagons ... the farm to the mill. No statistics are at hand ...heck this item, but the probability is that the ...nt of wheat hauled in wagons to the mill is a very ... proportion of the total; and hence this correction ...ch too large.

...re are three other errors in the above investiga... that make the conclusion too large: (1) The cor... ...ndent was asked: "What is the greatest distance ... haul to shipping point by any considerable number ...rmers?" The answer was assumed to be the radius ... the contributing area, regardless of the fact that ...ually, because of topographic or other conditions, ...oduce is hauled much farther from one direction than ...m another. This makes the distance of haul too ...reat. (2) The average weight of load was assumed to ... the mean between the largest and the smallest, re... ...gardless of the fact that most of the farm products go to market when the earth roads are in nearly their best condition, and consequently the maximum load is very much more common than the minimum and not equally frequent as was assumed. This error makes the assumed average load too small, and therefore makes the computed cost of marketing farm products too great. (3) The price per day of team and driver was taken as the "usual cost of hiring a team and driver," regardless of the fact that hauling is a secondary employment to farmers and that the conditions of service, cost of feed and driver, loss of time by bad weather, etc., are very different for the farmer and the professional teamster. The farmer claims that the assumed price per day for team and driver is much too great.

The above total, $84,684,000, is probably at least twice too large. However, even this sum is only $15 each for the 5,740,000 farmers of the United States, and therefore the alleged cost of bad roads in marketing the crops is not likely to bankrupt the farmer. Of course, only part of this sum would be saved if the farmer had permanently hard roads upon which to haul; and consequently only a fractional part of this sum is available for hard-road construction, if only the economics of the problem is considered. Good roads are of an advantage to any rural community, but they must be defended chiefly for other than economic reasons.

3. The third article referred to is a speech by a United States Senator in the Senate in 1904, which was circulated as a public document. The Senator also traveled about over the country, apparently making the same speech. The speaker heard it twice in one day in the same room. The Senator said that an Illinois farmer owning 100 acres can get permanently hard roads for a tax of $20 per year for 5 years, provided the State or National Government will pay an equal amount; and then he will have three ways in which he can make 100% on his investment. The speaker will examine this statement briefly.

Under the most favorable assumptions, the above tax amounts to $1,280 per mile. What kind of a permanently hard road can be built anywhere for that sum? What kind of a road can be built for this sum in the Illinois corn belt, where the Senator was speaking and where gravel or broken stone must be hauled about 100 miles?

The Senator's first method of making 100% on the road tax is as follows:

> The farmer would get at least 52 days' labor, when not engaged in his crop, with his team at $2.50 per day which would amount to $130, of which half, or $65, would be clear profit.

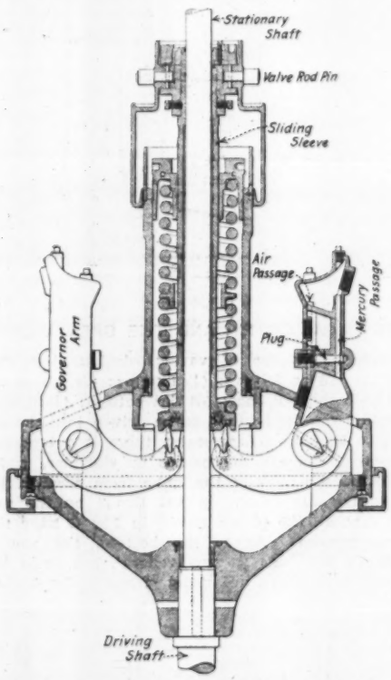
In the first place, the tax is $100, but the Senator only claims $65 profit when he promised $100! In the second place, as the farmer and the Government together only pay $200, can 65% of it be safely spent for hauling material?

The Senator's second way of paying the road tax was by the reduced cost of hauling produce to market. In computing the cost on earth roads he virtually counted the cost of team and driver at $3.75 per day, even though he had just said that at $2.50 per day half was clear profit! He also counted the produce per acre more than four times that given by the U. S. Census. Granting his estimates and assumptions, he showed a profit under this head.

The Senator's third way of paying the road tax was by the increase in the value of the land. All hard-road advocates count both the reduced cost of transportation and the increase in the value of the land, regardless of the fact that the second is the result of the first, and also regardless of the further fact that hard roads add nothing to the productivity of the soil.

THE AGITATION A FAILURE.—Attention has been called to some of the absurdities of three of the most prominent pieces of good-road literature known to the speaker; and, if it were desirable, he could present others which are equally startling, although not of as good parentage. When some callow bicyclist writes on road reform for his local paper, or some automobile agent writes on roads for a trade journal, or a carriage dealer makes a speech at an annual convention, the statements of the three articles referred to are accepted because of their authorship, and the changes are rung upon their statements without any question as to their truthfulness. Accepting the above statistics and estimates as true, the conclusion is drawn that the farmer is a fool not to act thereon, and consequently such productions not infrequently bristle with opprobrious terms applied to the farmer. Is it any wonder that the farmer has not been influenced, at least favorably, by such literature?

Many of the advocates of hard-road construction have not had an adequate comprehension of the facts and figures they have presented, and have greatly underrated the understanding of the farmers they wished to convert. The men who make public opinion in any rural community know that, while good roads may have greatly enhanced the value of real estate in the bedroom of some great city, such conditions cannot be widespread. The representative farmer understands the difference between the conditions under which he labors and those of the huckster near a large city. Even though hard roads may enable a farmer now and then to rush to town with a dozen of eggs, or a bushel of potatoes, or perhaps a load of hay, and obtain a fabulous price therefor, he knows that these conditions are exceptional;



Sectional View of Revolving Element of Turbine Governor.

and also that, if any considerable number of hard roads are built, producers must accept the general level of prices. The Illinois farmer understands the difference between his State and Indiana in the matter of proximity of road-building material; and he also understands the difference between the rich, sticky soil of his own State and that of Massachusetts, and believes that the experience in the Bay State is not a trustworthy guide for him. It may add spice to the article to embellish it with pictures showing wagons literally half buried in mud; but any man with sense knows that these conditions are not representative.

Within the past few years the agitation for hard roads has nearly ceased in the Prairie States, and, coincident with such subsidence, increased attention has been given to earth roads. When the hard-road agitation was actively going on, there was little or no demand in the farmers' institutes (meetings of the farmers to discuss agricultural topics) for articles or discussions on road topics; but recently there has been a large demand for information concerning the care of earth roads. This is very fortunate, for almost, if not absolutely, universally in this country the administration of road affairs is in the hands of small local official boards, which from the nature of our form of government are likely to change frequently. This condition imposes a well-nigh insurmountable limitation upon any comprehensive and continuous system of road improvement, unless the general public firmly believe in the value of the proposed system. Therefore it is highly important that correct information concerning road economics, road administration, and road construction should be widely disseminated. Unless a community is willing and able to maintain the earth roads in a reasonably good condition, it is useless to expect that it will be willing or able to support a high-class wagon road; and therefore the dissemination of correct information concerning the construction and care of earth roads is politically, economically, and physically the first step toward a better form of construction.

THE GLOCKER-WHITE TURBINE GOVERNOR.*

By W. M. White† and L. F. Moody.‡

The close regulation of large water turbines is made difficult by the water-hammer action due to the inertia of the water in the penstock. The comparatively sudden action of the ordinary centrifugal governor would produce too rapid changes in the position of the turbine gates, with harmful results proportionate to the head and volume of flow.

To bring about a sensitive and yet gradual governing action, a governor with hollow balls containing a shifting charge of mercury has been applied to four 13,000-HP. and two 500-HP. water turbines built by the I. P. Morris Co., Philadelphia, for the Electrical Development Co., of Ontario, Canada. The turbines are vertical with double runners discharging into a single draft-tube and are controlled by cylinder gates. These gates, weighing with the levers and rods which operate them some 15,000 lbs., must be handled by the governor.

A single-acting piston driven by oil at a pressure of 250 lbs. per sq. in. is employed to raise the gates, and the downward or closing movement is effected by the weight of the gates themselves and controlled by the escape of the contained oil from the cylinder. This cylinder is so large, on account of the great weight of the gates which it operates, that its valve is too heavy to be moved directly by the governor balls. A supplementary piston is therefore employed to control the valve of the main cylinder, and the valve of this supplementary or relay cylinder is in turn controlled directly by the governor balls.

The revolving element is shown in the figure. The governor arms, or "balls," moving in or out from the shaft transmit their motion to a sleeve which revolves upon it. A collar at the upper end of the revolving sleeve is provided with two pins which act upon the system of levers controlling the valve of the relay cylinder.

The most novel feature of the governor is the hollow and peculiar shape of the arms. Each arm contains an upper and a lower mercury chamber connected by a small vertical passage. This passage is intercepted by an adjustable plug having a small hole drilled through it at the point where it crosses the passage to allow the transference of mercury from one chamber to the other. The charge of mercury is placed in the lower chamber with the governor at rest. At the normal speed of 500 r. p. m. the centrifugal action is sufficient to cause the mercury to rise in the passage and divide itself between the two chambers. An air passage is provided in the arms on the side toward the shaft to permit a free flow. If now, for any reason, the speed tends to increase, more mercury will flow to the upper chamber at a rate determined by the size and position of the opening in the plug. If the speed decreases, the mercury will be partially or wholly transferred to the lower chamber.

The governor is so proportioned that if the passage were closed with the mercury in the normal speed position its action would be sluggish, permitting a variation in the speed of 100 r. p. m. from full load to no load. With the passage open, however, when the load is suddenly decreased and the speed tends to rise, the upward and outward movement of the mercury gradually increases the moment of inertia of the governor arms so that less speed is required to balance the spring. The quickness of recovery from any fluctuation of speed is controlled by the size and adjustment of the opening through the plug and by the shape of the mercury chambers. The shape shown was not worked out mathematically but is the result of several preliminary experiments. This governor is a special design not intended as a competitor of the many excellent commercial governors and has proved very successful.

A CORE WALL OF STEEL SHEET PILING has been used in a new embankment built on the marshy ground of the Gulf Coast to protect Fort St. Philip, La., from the flood water of the gulf. The length of the levee or embankment is 4,400 ft. The steel piles are of the United States interlocking type, and the specifications of the government engineers required them to be coated with an asphalt composition. This composition was thoroughly dry when the piles were driven. To ensure watertightness of the interlocked joints of the piles, these joints were filled with cement grout. The piles are 19 ft. long, and project 5 ft. above the top of the levee. This portion of the piling is enclosed in a concrete wall, 6 ft. high and 12 ins. thick, reinforced with steel rods.

*Condensed and rearranged from an article in "Power and the Engineer," Aug. 4, 1908.

†Chief Engineer, Hydraulic Department, I. P. Morris Co., Philadelphia. ‡Assistant to Mr. White.

SOME SPECIAL DESIGNS OF RAILS AND TIE-PLATES.

The track construction of every important railway presents individual features and details, in spite of the fact that the type of track is universal, as pointed out in our issue of Aug. 20, 1908. We present herewith some special features in standard rail and tie-plate designs, illustrative of varying ideas in design.

RAILS.—The form of rail section recommended some years ago by the American Society of Civil Engineers has come into very extensive use, and has rendered obsolete a great number of sections formerly used by individual railways. There are, however, some important railways which have not adopted this type of rail. Thus the New York Central Lines and the Union Pacific and Southern Pacific systems use rails of the Dudley type; and the Pennsylvania R. R., the Gould system of railways, and some other lines, have special sections of their own. Two of these special sections, each weighing 85 lbs. per yd., are shown in Fig. 1. The dimensions are given in the accompanying table.

The first section (at the left) is the standard 85-lb. rail of the Western Pacific Ry., the important new line now being built from Salt Lake City to San Francisco in the interest of the Gould system. Its special features are the rounded and flaring sides of the head, the vertical sides of the web, and the sharp bottom corners of the base. The rails are spliced with 25-in. angle-bars weighing 52.2 lbs. per yd., and having four holes 6 ins. c. to c. The alternate holes are 15/16-in. diameter and 1 × 1¼ ins., this arrangement being used with bolts placed with head and nut alternately on each side of the rail. The holes in the rails are 1⅛-in. diameter. The area of cross-section is 8.349 sq. ins., distributed as follows: head, 3.814; web, 1.506; base, 3.029 sq. ins. Mr. Virgil G. Bogue is Chief Engineer of this road.

The second section (at the right) is the standard 85-lb. rail of the Great Northern Ry., and is the development of a 77½-lb. rail which was used previously. The special peculiarity is in the head, which has a wider flare for the sides and a greater radius for the top corners than even the rail shown in Fig. 1. The joints are spliced with angle bars having four bolts spaced 5 ins. c. to c. For these particulars we are indebted to Mr. A. H. Hogeland, Chief Engineer.

STEEL TIE-PLATES.—The use of steel tie-plates to protect wooden ties from wear is now a general feature in railway track construction. These plates are of various designs but may be classed as follows: (1) flat top; (2) rib on top to hold the rail base; (3) flat bottom; (4) flanges or lugs on the bottom, to be driven into the tie. As to the top arrangement, there is a tendency towards the use of the rib or shoulder, which relieves the neck of the spike from some of the pressure due to the lateral thrust on the rail. In fact all the plates shown in Fig. 2 have this arrangement. As to the bottom, the use of flanges and lugs is very general, but some important railways are using either a flat bottom or flanges so small as simply to bite t[he] of the tie sufficiently to prevent slippi[ng].

The tie-plate of the Kansas City Sou[thern] (Mr. A. F. Rust, Chief Engineer) is p[ro]having its bottom flanges thickened on edge so as to present a bulb or barbe[d] section. The purpose of this is to get hold in the wood of the tie, due to pressing back so as to lie against th[e] part of the flange after being displace[d] larger part. This is known as the "fi[sh] plate.

The standard tie-plate of the New Y[ork] Haven & Hartford Ry., has a top and bottom flanges. The size is ins. for 80-lb. rails, and 9 × 5 ins. lb. rails. All the plates have fo[ur] holes, and the plates used at joints have an additional hole spike in the angle bar. Mr. Edward is Chief Engineer.

The standard tie-plate of the R. R. of New Jersey (Mr. J. O. Chief Engineer), is of the flat type, with a shoulder on the upper receive the edge of the rail base. is a recess in the bottom, in order duce the weight. A somewhat plate used on other railways has recessed channels in the top, partly duce the weight and partly to allow escape of sand and dirt which may under the rail. It will be noted that plate has a slot for a spike which is independent of the rail spikes. The of this is to hold the plate in position so prevent the chattering which often curs with flat plates when the rail spikes are loose. The use of screw spikes would obviate this difficulty, in addition to making the track more secure.

The new standard tie-plate of the Chicago, Rock Island & Pacific Ry. has been designed in connection with the recent standardization of details in track, bridge and other work. This has been carried on under the direction of Mr. J. B. Berry, Chief Engineer. The plate is a compromise between types 3 and 4 (mentioned above). While it has flanges on the bottom, these are so small (⅛-in. deep) that they serve to prevent slipping rather than to attach the plate to the tie. On the other hand, the plate is ½-in thick throughout.

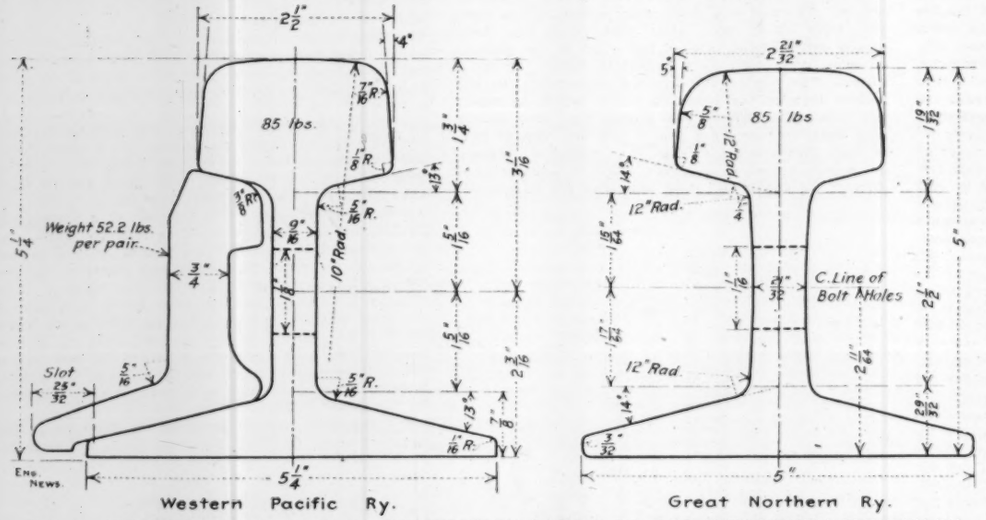


FIG. 1. STANDARD 85-LB. RAILS OF THE WESTERN PACIFIC RY. AND THE GREAT NORTHERN RY.

DIMENSIONS OF 85-LB. RAIL SECTIONS.

	Western Pacific Ry.	Great Northern Ry.	Am. Soc. C. E.
Height, ins.	5¼	5	5⁹/₁₆
Width of base, ins.	5¼	5	5⁹/₁₆
Width of head at top, ins.	....	..	2⁹/₁₆
Width of head at bottom, ins.	2½	2²³/₃₂	2⁹/₁₆
Side of head, slope, deg.	4	5	Vert.
Depth of head, ins.	1¾	1¹⁹/₃₂	1²³/₆₄
Height of web, ins.	2⅝	2½	2⅝
Depth of base, ins.	⅞	²⁹/₃₂	²⁷/₆₄
Thickness of web, ins.	⁹/₁₆	²⁵/₃₂	⁹/₁₆
Height to c. of bolt hole, ins.	2⁹/₁₆	2¹¹/₆₄	....
Radius, top of head, ins.	10	12	12
Radius, top corners of head, ins.	⁷/₁₆	⅝	⁹/₁₆
Radius, bottom corners of head, ins.	⅛	⅛	¹/₁₆
Radius, fillets of web, ins.	⅝	¼	¼
Radius, corners of base, ins. (top)	¹/₁₆	³/₃₂	¹/₁₆
Radius, sides of web, ins.	Vert.	12	12
Edge of base	Vert.	Round	Vert.
Fishing angles, degs.	13	14	13
Metal in head, p. ct.	45.7	42	42
Metal in web, p. ct.	18.0	22	21
Metal in base, p. ct.	36.3	36	37

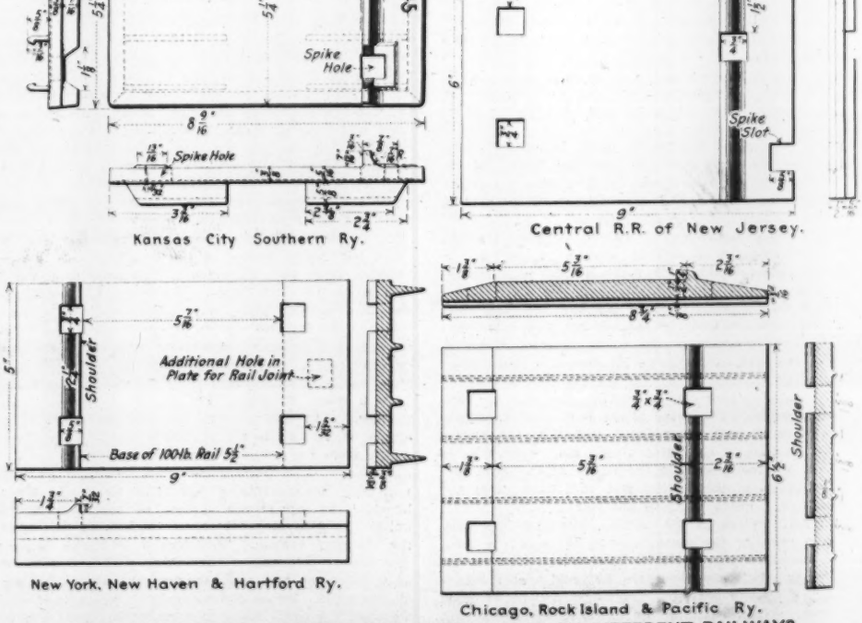

Spike Hole
Kansas City Southern Ry.
Central R.R. of New Jersey.
Additional Hole in Plate for Rail Joint
Shoulder
New York, New Haven & Hartford Ry.
Chicago, Rock Island & Pacific Ry.

FIG. 2. FOUR TYPES OF METAL TIE-PLATES IN USE ON DIFFERENT RAILWAYS.

ENGINEERING NEWS

A Journal of Civil, Mechanical, Mining and Electrical Engineering

Published every Thursday by

THE ENGINEERING NEWS PUBLISHING CO.

220 BROADWAY, NEW YORK

BRANCH OFFICES

CHICAGO: 1636 Monadnock Block
WASHINGTON, D. C.: Home Life Building
ATLANTA: Candler Building
RUDOLPH MOSSE, BERLIN AND HAMBURG, GERMANY
Z. P. MARUYA & Co., Ltd., TOKYO, JAPAN

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The extraordinary number of railway collisions during the first ten days of this month in which work trains have been concerned calls attention to the need of improvement in the methods of controlling their movements. So far, the fatalities resulting from these accidents have been confined to railway employees, and as long as this continues to be the case, the average passenger is apt to remain indifferent. From the reports, however, the fortunate exemption of passenger trains from participation in these wrecks appears to be the result of chance. Neither are these collisions confined to roads notorious for poor management. In every instance reported, they are the result of general carelessness or disregard of orders on the part of the work train crew. Such trains, operated by irresponsible employees, careless of their own safety, constitute a menace to the security of the whole system of transportation.

The underpinning of tunnels in soft material, in order to provide additional support and to prevent settlement or disturbance, is required only in very rare cases, but when it is required it calls for very special methods of treatment and is performed under difficulties. Such work has been carried out at New York for one of the East River tunnels of the rapid-transit railways, and is provided for in the Hudson River tunnels of the Pennsylvania R. R. In both these cases, the tunnels are pairs of single-track iron-lined tubes, and the underpinning consists of piles which are either attached to the tunnel shell (as planned for the Hudson River tunnels) or carry transverse cradles (as at the East River tunnels).

A remarkable piece of work of this kind has been carried out in Paris, and differs essentially from either of the cases noted above. In this case the structure to be underpinned was a double-track masonry subway along one bank of the river Seine, forming the terminal section of an important railway. One of the tunnels of the underground rapid-transit railway system will pass beneath this subway and the river, and as the material here is a deep bed of water-bearing sand, the liability of movement of that material and possible settlement of the subway had to be considered seriously. The railway company deemed it advisable to provide some support for its subway structure before the tunneling operations were commenced.

The use of piling was impracticable, of course. The plan adopted was to sink piers under the line of the walls of the subway, carrying them down to a firm foundation below the level of the new tunnel. Upon these are longitudinal girders which support the walls. Between the girders are transverse floor beams, embedded in a concrete floor or invert. The details of this interesting work, and the methods of carrying it out in the face of very heavy traffic, are described elsewhere.

In some respects this very novel work resembles the "subaqueous viaduct" construction which has been proposed as an alternative for tunnels in cases where the depth is too great or the material too soft and unstable for tunneling. These structures are designed to have tubular spans lying in water or soft mud and supported by piers sunk to firm foundations. Different designs for such construction have been described in our columns. One structure of this kind was actually commenced (at London) several years ago, but this was never finished. It may be noted that the tube sections of the Detroit River tunnel form submerged spans of 262½ ft. when first sunk in place, as they are supported only by grillage foundations at the ends. When in position, however, concrete is filled in beneath them. We believe that the work at Paris is the first case in which a tunnel has been supported on girders bridging between foundation piers sunk to a more stable foundation than that afforded by the material in which the tunnel itself is situated. The girders are designed, of course, to carry the entire load of the tunnel in the event of the material in which it lies settling away from beneath it.

The recent convention of the still young Illuminating Engineering Society, reported elsewhere in this issue, brings into prominence several desirable tendencies in the development of modern artificial-lighting methods. The remarkable growth of this society and the interest shown by its members in each other's work are signs of a coming prevalence of more artistic and more hygienic lighting.

There seems to be, first of all, a general acknowledgment of the responsibility of architects and of gas and electrical engineers for the prevalent deterioration of eyesight and a general agreement that it is their duty to prevent such troubles. This is noticeable at present in a marked tendency to frown down the use of glaring lamps outdoors as well as indoors. The widespread demand for a better diffusion of light, by shading and frosting lamps is now extending to outdoor lighting. Closer study seems to be given to the efficiency of light production and distribution in order that more and softer light can be produced at the present cost of running less effective arrangements.

While it is evident that the manufacturers of the newer gas-lighting apparatus are seeking in the development of their lamps for a more and more efficient production of light, it is nevertheless noticeable that no such attention is widely given to the wisest adaptation and arrangement of the gas apparatus. The notable studies in artistic and effective illumination are being made with electric systems instead of gas. Securing uniform local and general illumination by special shades and studied arrangements of lamps is much more easy with electric lamps than with gas. Not nearly as careful studies are made for the design of illumination with gas as with electricity.

The blame for this backwardness should be placed not on the manufacturers of gas lamps, but rather on those gas-distributing interests which would prefer to have gas used instead of electricity or on those who have to specify the number and type of gas burners to be employed in everyday installations. The results of illumination studies made with electric installations are generally applicable to gas lighting and can profitably be so employed. Gas lighting forms such a large proportion of the total artificial lighting, both in this country and abroad that material improvement in the artistic and hygienic value of our average lighting will be attained only with more careful attention to commercial and everyday installations of gas lamps. As a good example of what can be done with gas lighting, one needs to note the improvement in railway-car lighting by what is popularly called "Pintsch gas." The esthetic qualities of the latest lamps, the softness of the light and its efficient production, the real comfort arranged for the passengers are most commendable in comparison to the characteristics of the early open-flame burners and are greatly in contrast with some modern stationary installations.

A novel system of breakwater construction is being used in the harbor improvements at Algoma, Wis., and is described elsewhere by the engineer in charge, who is also the inventor. The system consists essentially in the use of large boxes or caissons of reinforced concrete, forming sections of the breakwater. These are built on shore, launched like vessels, towed into place, sunk by means of water ballast, permanently filled with stone, and finally covered with a concrete deck or superstructure. This system of construction for breakwaters, piers and similar structures is the invention of Major W. V. Judson, Corps of Engineers, U. S. Army, and a patent was granted to him on March 19, 1901. Since that date, similar methods have been used in Canada and to some extent abroad. The use of such caissons for the dock walls at Rotterdam was described in our issue of Jan. 17, 1907. The purpose in this case was to reduce the amount of mass concrete required in the monolithic blocks frequently employed for work of this kind, and to reduce the difficulties of handling and setting these enormous concrete blocks. The caissons were easily placed, and the necessary weight for stability was given by a filling of stone, sand, gravel or second-class concrete at small cost. The first application of the system in this country, however, has been during the present year on the work at Algoma. We are informed that Major Judson receives no royalty from the United States, having patented his system largely to protect the interests of the government. It will be seen that the system represents a decided departure from ordinary methods, and that it is applicable to various kinds of work.

A PLAN FOR SUBWAY FREIGHT DISTRIBUTION IN NEW YORK CITY.

For more than a decade the problem of freight handling on Manhattan Island by more economical methods than those now in use has been a subject of active discussion by the engineering profession. Several times the proposal has been made to build an elevated belt line around the city, so that railway cars could be brought directly to the piers on the water front. Opposition to the placing of further elevated structures in the city streets, combined with large uncertainty as to the real economy which such a system would effect, has prevented all these schemes from advancing further than the paper stage.

The subject is now brought before the profession again by a report made to the Public Service Commission by Mr. Wm. J. Wilgus, M. Am. Soc. C. E. Mr. Wilgus's notable achievements in connection with the New York Central lines, while he held the office of Vice-President and particularly in connection with the electrification of the terminal lines at New York, give him such high standing that his proffered solution of a great engineering problem deserves careful attention and cannot fail to be of interest to the profession generally.

Our leading article in this issue describes the main features of Mr. Wilgus's plan. Its boldest feature, without doubt, is the proposal to transfer all freight to small cars at great classification and transhipping yards and stations, one located on the Hackensack Meadows in New Jer-

sey and the other at the 60th St. terminal of the New York Central.

The idea of handling all the freight for a great city like New York in small cars is an entire novelty. The nearest precedent is the Chicago subway tunnel system; but this was designed to handle and does handle only a small proportion of the freight entering the city and is greatly handicapped by its very small size and by its depth below the surface. Mr. Wilgus proposes cars of about 10-tons capacity running on standard gage tracks and with a height and width of only 6 ft.

So accustomed have we become to the idea that breaking bulk must be avoided at all hazards for economical freight handling that Mr. Wilgus's plan may seem to a superficial observer to be handicapped at the start. It is true, of course, that the cost of transfer from the standard freight car to the special cars, averaging perhaps 25 cts. per ton, is an expense at the outset; but let us see what is gained by the use of the small car.

Mr. Wilgus's idea, we judge, is that the small size subway which the small car makes possible will make financially practicable what is certainly impracticable if full size railway tunnels were attempted.

It is or ought to be fairly clear that no scheme for bringing full size freight cars down the North River water front, on tracks either elevated or underground, can hope for success. The elevated system will not be acceptable to the public. The underground system would be prohibited by its expense and would involve most serious if not insurmountable difficulties in construction and operation.

Mr. Wilgus's proposed tunnels are to be only 8 ft. 6 ins. in height and width. The difficulties and the cost of building such small subways, compared with building subways of say 12 × 16 ft., required to pass standard freight cars, will be reduced in even greater proportion than the relative size would indicate.

We may take space to note only one or two reasons for this: First, the surface of West St. (the marginal street in front of the North River piers) is very little elevated above tidewater. The earth beneath it is a saturated sand and made ground material. Excavations in it to any considerable depth will be difficult to maintain and to keep dry. Subways built in it must all be waterproofed and any seepage must be taken care of by pumping. Further, all the sewers on the west side of the city cross this street, and a deep subway would cut them off while a shallow subway might be run between their tops and the street surface. The making of even an 8 ft. 6 in. subway will involve difficulties enough, but a subway for standard-gage freight cars on West st. would be wholly impracticable.

We may note in this connection that there are occasions when phenomenally high tides and heavy rainfall actually place parts of West. St. under water. To keep out the wet from the complicated system of tunnels which Mr. Wilgus proposes will be about as difficult a piece of waterproofing work as has been attempted in a long time.

Besides these structural reasons there are operating reasons which have governed Mr. Wilgus, we judge, in his adoption of the small size car and subway. He knows from his railway experience that switches and sidings are as necessary to a railway's operation as the main tracks themselves.

A number of years ago a commission of three distinguished engineers, among them the late Geo. S. Morison, deliberated on the problem under discussion and evolved a recommendation for a four-track freight railway on West St., with branches to every pier. It was promptly pointed out by railway engineers that this proposed line would be so blockaded by switching movements as to cut down its capacity far below the point at which it could pay a profit on its cost.

Study of Mr. Wilgus's scheme shows that he has had in mind the necessity of keeping his main tracks clear. His subways are so small that he finds room for four tracks side by side with incline tracks between leading to the lateral spurs to piers and warehouses in the side streets. These inclines make possible the passage from one track to a spur on the opposite side without the use of grade crossings and consequent blocking of train movements. It should be noted that the use of small special cars makes sharp curves possible so that a much more compact and complete system of connections is possible than could be made with standard-gage tracks and cars.

For the operation of his system he plans to have continuous movement, in one direction only, on all tracks. Reverse movements are absolutely prohibited. Only by this means could the system be worked at all. Its capacity and efficiency depends on keeping the tracks clear for continuous movement from the transfer house at one end to the warehouse and piers at the other.

The only doubtful questions about this notable scheme relate, it seems to us, to this point. Can the flow of traffic be made continuous enough and uniform enough day by day and hour by hour, so that the desired capacity may be attained and congestion and consequent blockading be avoided? The problem is so novel a one and precedents are so entirely lacking that it seems difficult to give a positive answer.

The test of every transportation system comes when it is called upon to handle the "rush-hour" traffic. It is the fact that business alternates between feasts and famines that prevents most railways from paying fat dividends.

The test of Mr. Wilgus's system will be in handling the rush of traffic when a fleet of ocean steamships comes into port at once and their cargo must be promptly transferred; or when a snow blockade in winter is broken and a long series of delayed trains pours in with lading to be transferred to a city whose supplies are running low. At such seasons at least, the success or failure of the enterprise will depend on how many tons per hour and per day can be passed over the system, and this will depend, more than anything else, on reduction of the interval between trains. Long trains will not be possible with this system for obvious reasons. An average net train load of 50 to 75 tons will be a creditable performance. From the main transfer yard outward, it will be comparatively easy to dispatch trains in a continuous procession with intervals of not more than two or three minutes. For the movement in the reverse direction, however, trains must be started from forty or a hundred different points and it will be a difficult problem of organization so to harmonize the movements from all these points that conflicts and delays and consequent reduction of traffic capacity shall not occur.

We point out these things to show how absolutely the success of the system in operation will hinge on the method adopted to harmonize movements on all the different parts. We may point out also that the actual undertaking of the enterprise will be dependent on the harmonious cooperation of the city authorities, the railway and steamship corporations and particularly of the merchants and shippers on whose premises these proposed freight subways would terminate. The task of securing the approval of these last-named parties would probably prove more difficult than all the rest of the enterprise; yet so far as we can see, that approval is essential since if the system were carried out on any piecemeal scale, a large part of the economies sought would not be obtained.

In any event Mr. Wilgus deserves great credit for his bold and original solution of a problem that presses hard upon New York City, and for which, so far as the New York Central lines are concerned at least, a radical change from existing conditions is absolutely necessary.

MORE CONCERNING ENGLISH HIGHWAYS.

[Editorial Correspondence.]

In a previous letter I referred to the contrast between the surface of the macadamized roads of England and those of the United States. There are some other contracts between the highway systems of the two countries that are particularly worth study by American engineers at this time when the movement for improved highways is taking definite shape throughout the United States.

One of these notable contrasts is in location. It is safe to say that most of our American highways were never really "located" in an engineering sense. Like Topsy they "just grow'd." Most of our roads still run where chance or circumstance in the first settlement placed them. And this chance and circumstance not seldom left them to make needless ascents and descents, to cross stretches of sand and swamps that might have been avoided, to turn sharp corners where easy curves might have been made, to follow roundabout courses for no better reason than to avoid crossing farm boundaries.

In England, too, it is doubtless true that many roads follow routes which were marked out by haphazard accident, no one knows how many hundred years ago; but England had an era of good roads building before the railway came to revolutionize transportation. We have to remember that the English highways were transformed to good roads when England had become a densely populated and wealthy country, and to this population these highways were (save for water routes) the only avenues for transportation. It was worth while, therefore, to cut down grades and ease curves for the highway traffic in England during the latter part of the 18th and the early part of the 19th century; and engineers were employed to do this work. There can be little doubt that it was experience in highway location as well as canal building that equipped the English engineers to undertake railway construction after the elder Stephenson's successful demonstration with the "Rocket."

And it is not only the fact that English roads have been located with easy grades and curves to which I would direct attention. I believe I am not mistaken in saying that English roads have been—in large part at least—built as avenues to connect cities and towns and villages, while American roads—a large proportion of them—were primarily designed to reach every farmer's house. Underlying this is a striking contrast between the social and political organizations and systems of land tenure of the two countries which is of more than engineering interest.

In my own native State of Vermont, for example, each town is obliged to furnish a highway to the homestead of every resident. There have been cases, I believe, where towns have actually purchased remote mountain farms rather than incur the expense of building a road thereto. In the original settlement of most of our country the land was first occupied as farms. Villages and cities were a later growth. The first demand for roads, therefore, was to reach the scattered farmhouses, and the roads have thus been originally located with little care for direct connection between the present centers of population, many of which indeed did not then exist at all.

Turn now to England and we find radically different conditions. From very earliest times there has been a tendency for the farming population to huddle in villages and hamlets for mutual protection and defence. Even today rural England seems sparsely inhabited compared with many fertile sections of New England and the Middle States. There is no such multiplicity of small farms and scattered farmhouses to be seen. The land is cut up into small fields indeed, but private farm roads suffice to reach these. Thus it comes about that while all or substantially all the public highways of England are macadamized roads, their mileage in proportion to area appears to be actually less than in the older settled States of America.

In facing the task of building a good roads system in the United States therefore, and studying the experience of other countries, we should bear in mind that the English roads system, which has been so justly admired, does not attempt to reach every remote farmhouse, but is actually a system connecting centers of population, small centers many of them it is true, but nevertheless centers.

Perhaps the most surprising thing to an American who views for the first time the roads of

England is the money which has been lavished upon them. It seems to be the general rule for roads in England to be lined on both sides with stone walls, and by stone walls I do not mean a rough barrier of loosely piled field stone, such as one still sees occasionally in parts of New England. No, the stone walls which fence in English roads are made with good flat stone laid up with mortar and as smooth and well built as the wall of a stone house. More often than not, it is finished with a substantial coping. These walls are higher than a man's head as a rule and not seldom in a cut they are built as retaining walls and with well trimmed hedges on top of them. Whether these walls are built and maintained by the road authorities or by the land owners whose property they front I am not informed, but they furnish an excellent illustration of the lavish manner in which money is spent on permanent improvements in the mother country. The rule seems to be if you build at all to build in the most substantial and enduring manner possible. The American rule of so building a structure as to make a dollar earn the most interest seems unknown. In highway bridge construction for example, the rule appears to be—a stone arch or nothing. Iron truss highway bridges over small streams, which are so universal in the United States, are rarely seen in England. But there are many localities where a stone arch bridge cannot be built without much difficulty and expense. As a result one finds in England primitive ferries still in operation over streams hardly a stone's throw across and I even found on one main highway in middle England a small brook crossed by fording.

This, however, is by the way. The important fact, I think, for us to note, is that the English road system with its lavish use of masonry in bridges and walls and drains has been built without counting the cost to see whether it paid or not.

Does it pay? Would the abutting farm land stand an annual tax equal to the interest on the cost of these roads and that of their annual maintenance? I doubt whether the question has ever been asked or answered in England and it would be presumptuous in me to attempt to answer it categorically from my limited observation. My impression is, however, that so far as much of the farming lands are concerned, they could by no means stand the burden which such a tax would involve.

Some of our American good roads advocates have been lavish with arguments to prove that the farmers could get rich quickly by borrowing money to build good roads. Such arguments rest on no very sound basis. British agriculture is well known to have suffered a severe decline during the past generation, as measured by the values and rentals of agricultural lands and good roads have not saved it. This does not mean that good roads are of no benefit to the farmer, English or American, but that the benefit in reduced cost of transporting farm products to market are not so great as to permit good road construction to be carried out in districts purely agricultural without careful inquiry as to the cost and the resultant benefits.

We shall get at the root of the matter, I think, if we say that the costly road system of England is to be regarded not as an income-yielding investment but as a public heritage from a past generation. If we were to regard this road system solely from the engineering point of view of making the fewest dollars earn the most interest, then roads much cheaper in construction might have served the purpose for the volume of traffic that now uses the highways.

But public improvements in European countries are not made in this way. Whether one studies castles and cathedrals and palaces or roads and bridges and docks, one is continually impressed with the fact that he is viewing the results of the accumulated industry of many generations of men, and of men who were building works to endure for centuries. In this indeed lies some part of the charm of these older civilizations. We in America in the present day are coming to build in like manner. Just as we are adding to our stock of worthy public buildings, churches, schools, museums and libraries, so we should add to our mileage of well located and well built public highways.

There are, doubtless, locations where the indirect benefits from good roads construction may represent a financial saving sufficient to warrant undertaking the work as an investment. It is far safer, however, to consider good roads construction in country districts apart from indirect financial returns. The question to ask is not "Will it pay?" but "Can it be afforded?"

It is important to note this difference because many well-intentioned good roads advocates in the United States contend that money should be borrowed through the issue of bonds on an enormous scale by the nation or states or smaller divisions and the proceeds invested in good roads construction. But financial danger lies along that path. Our cities and towns are many of them close to the constitutional debt limit already because of necessary public improvements. It is as risky for a city or a state to borrow money to spend on luxuries as for an individual to do the same. The debt must be paid sooner or later, and until it is paid interest will be added annually. A bond issue for good roads may indeed give a sudden stimulus to the work of construction; but in a period of years more money can be spent on roads and more miles of roads can be built by adopting the policy of "pay as you go," and raising the money by taxation as fast as it is required.

Great Britain is a small country densely populated, but if she had still to pay interest on the cost of the highways built a century ago it would be a large addition to her present heavy burden of taxation.

In the United States, with our enormous area, much of it still sparsely settled, the task of building a complete system of good roads is not one to be accomplished in a few years, but one that must extend over many decades. We shall finally attain a complete network of improved highways, equal to that of the mother country, if we keep steadily at the task as fast as our means permit. The desired end will be sooner reached than if we increase the burden of public debt and taxation by huge bond issues for this work.

C. W. B.

London, Sept. 15, 1908.

REINFORCED-CONCRETE CAISSONS FOR A BREAKWATER AT ALGOMA, WIS.

By W. V. JUDSON,* M. Am. Soc. C. E.

At Algoma, Wis., on Lake Michigan, the United States Government is building a small outer harbor, and reinforced-concrete caissons are used in constructing 500 lin. ft. of breakwater, which constitutes that portion of the work most exposed to wave action.†

The caissons are built upon and launched from marine ways at Kewaunee harbor, Wis., 12 miles from Algoma. The ways consisted of nine 12 × 12-in. stringers, with an inclination of 1 on 10. They were supported upon capped piles, terminated about 5 ft. below the water, and afforded space for the construction of three caissons before the first was launched.

The design of the caissons is shown in Fig. 1. Each caisson is 25 ft. long, 12 ft. 4 ins. high and 15 ft. wide. The side and end walls are each 1 ft. thick. The bottom is 16 ins. thick, not including the planking (which will be mentioned later), and the single cross wall is 10 ins. thick. The reinforcement is of deformed steel bars, and is designed to afford resistance (with large factors of safety) to the water pressure inward, the pressure outward of the filling, the reactions of the foundation under assumed unfavorable conditions, wave action, etc. Each caisson weighs, in air, about 120 tons.

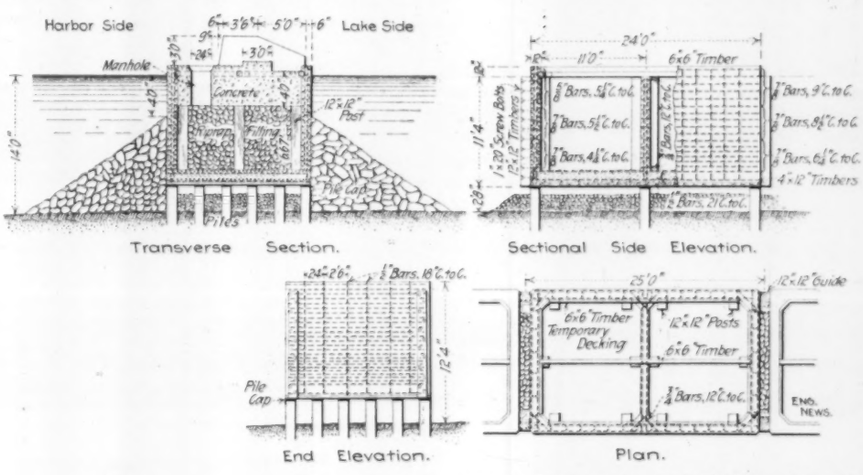
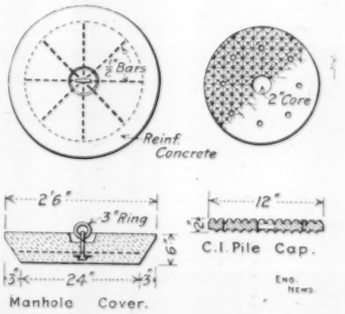


FIG. 1. REINFORCED-CONCRETE CAISSONS FOR BREAKWATER AT ALGOMA, WIS.
Major W. V. Judson, U. S. A., Inventor.



Work upon the caissons was begun about June 1, 1908. After the small force became well organized it was found convenient to build them at the rate of two per week. Considering the space available on the ways, this permitted the elapse of ten days between the placing of the concrete in a caisson and the operation of launching. The forms, of course (except the bottoms), were removable; three sets in all were used for the 20 caissons required. The bottoms of the forms consisted of 4-in. planks, which were fixed to the concrete above by spikes, and eventually constituted a portion of the caisson.

After the forms were removed, the caissons were roughly waterproofed with a wash containing cement, lye and alum. Before launching, a temporary wooden deck was placed on each caisson. No difficulties were experienced in launching, the caissons starting by gravity and taking gentle plunges, momentarily submerging, and then floating with the tops nearly 3 ft. out of the water. The caissons were towed by a small fishing tug from Kewaunee to Algoma. Sometimes one caisson and sometimes two were taken at a trip. Lake Michigan at times being moderately rough. At Algoma, the caissons were parked temporarily, and the wooden decks were removed and returned to Kewaunee by the tug.

*Major, Corps of Engineers, U. S. Army; U. S. Engineer Office, Milwaukee, Wis.

†This caisson construction is the invention of Major Judson, as noted elsewhere.—Ed.

The foundation for each caisson at the Algoma breakwater consisted of 18 piles, 6 under each end and cross wall. These were cut off at 11 ft. 5 ins. below the water surface. Upon the top of each pile was placed a cast-iron disk with a sort of waffle-iron pattern cast on both upper and lower surfaces. When a caisson was sunk, its weight caused the projections of the iron disk to embed themselves in the pile head below and into the plank bottom of the caisson above, thus introducing a desirable amount of friction and somewhat equalizing the bearings.

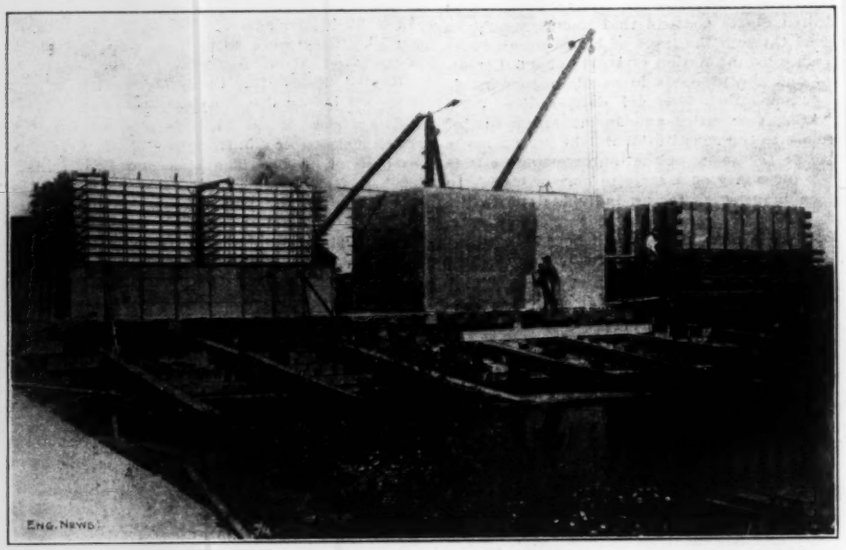


FIG. 2. THREE REINFORCED-CONCRETE CAISSONS ON THE LAUNCHING WAYS.

When the foundation was prepared for several caissons, the latter were towed out, held in position by lines, and sunk by means of water introduced through siphons. Riprap stone was then thrown in and brought up to a level 4 ft. below the top of the caissons; that is to say, to a level 3 ft. below the water surface outside the caissons. Any excess of water having been removed by means of a steam siphon, burlap was placed upon the riprap stone and the caissons were then filled even full with meager concrete. A portion of this was left rough in order to form a bond with the superstructure. This latter was constructed in place, in monoliths 25 ft. long and 4 ft. thick. Through the slab of concrete in the top of each compartment was left a manhole to provide for any future contingencies. This manhole was closed with a reinforced-concrete cover (Fig. 1). Finally the caissons were heavily riprapped on both the harbor and lake sides.*

The caissons have all been finished and towed to Algoma. The reinforced-concrete breakwater is almost completed, together with about 928 lin. ft. of new pile and plank pier (stone filled).

The work at Algoma included, besides the above, considerable dredging and the demolition of about 650 lin. ft. of old wooden pier. Work was begun in June, with United States plant and hired labor, and has been carried forward with remarkable speed. The cost will be considerably less than the lowest bid received after due advertisement, and somewhat less than the estimated cost.

With regard to the novel portion of the work, the reinforced-concrete caissons, it may be remarked that no unforeseen difficulties have arisen. The launching of each caisson occurred with perfect smoothness; no caisson leaked materially; and there was no trouble about the towing. In fact, the work has gone forward more cheaply and more quickly than was anticipated, and there were no exciting or unlucky incidents to chronicle.

*The illustrations of the work, Figs. 2 to 4, require little explanation. Fig. 2 shows three caissons on the launching ways. The middle one is complete; the one on the right has the reinforcement in place, and the outer covering of the form is partly built. Fig. 3 shows four caissons sunk in place, the stone filling of the first one being visible; in the third is the siphon pipe connected with the plant on the derrick boat. Fig. 4 shows the harbor side of a completed section, with the manholes (in the concrete covers) to give access to the caissons and one of the blocks forming the superstructure on the lake side of the breakwater. The concrete for another of these blocks is being deposited.—Ed.

THE LAKES-TO-THE-GULF DEEP WATERWAY CONVENTION.

The third annual convention of the Lakes-to-the-Gulf Deep Waterway Association was held in Chicago Oct. 7 to 9, with a large and enthusiastic attendance. The meetings were held at the Auditorium Theater. The opening address by the President, Mr. Wm. K. Kavanaugh, outlined the purpose of the association and its relations to similar associations organized for river improvements, Atlantic coast waterways, etc. The decline of river navigation and traffic was shown, and the necessity of its revival was urged. The report of the Secretary, Mr. Wm. F. Saunders, recited the history of the association, which was organized in 1906 as a result of an

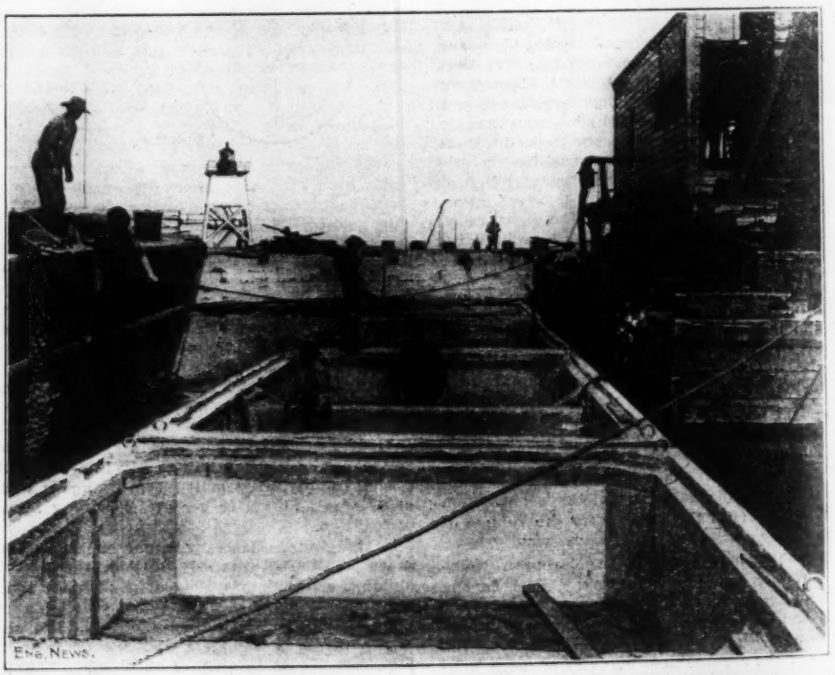


FIG. 3. CAISSONS SUNK IN PLACE AND PARTLY FILLED WITH STONE.

announcement from Congress that there would be no River and Harbor Bill that year, as the money was needed for other purposes. So great was the public objection to this policy that it was modified. The first convention was held at St. Louis in 1906, and the second at Memphis in 1907.

During the short life of the Association President Roosevelt has appointed an Inland Waterway Commission, the State of Illinois has formulated a project for connecting Lake Michigan with the Illinois River, and various other minor but important developments have occurred. The Board of Governors of the association have decided that $25,000 a year are required to carry on the work. During the year ending Oct. 1, 1908, the association has received $12,[illegible] and it has a cash balance on hand of $3,284.

At the convention of 1907, an address was delivered by President Roosevelt, and this was published in our issue of Oct. 10, 1907. At the recent convention addresses were made by the two presidential candidates, Mr. Wm. H. Taft and Mr. Wm. J. Bryan. We give herewith some extracts from these addresses. The extracts from Mr. Bryan's address are comparatively short, for the reason that he dealt mainly with generalities and expressed his desire to carry out whatever the people might want. Mr. Taft, on the other hand, presented some very definite views and opinions, and he had evidently a clearer understanding of the problem.

ADDRESS BY MR. TAFT.

The question of the systematic improvement of our inland waterways is one which our government has all too long neglected. Until recently, appropriations for that purpose have not been made according to any established plan or system of policy, but rather according to the varying degrees of insistence of the representatives of the different districts or sections of our country, and without proper discrimination between the relative merits of projects. Nor have such appropriations always been made in such amounts and with such regularity as would insure economical prosecution of the work and with a view to its speedy completion. And so it is that, after the first century of our existence, we find our inland waterways, with a few notable exceptions, unprepared for the uses of transportation.

But the consideration of their permanent and extensive improvement according to some general and comprehensive plan, so as to mold them into a complete system of transportation, has now forced itself upon us with surprising suddenness.

No other nation has been favored with so magnificent a system of navigable lakes and rivers, searching in their providential distribution every section of the great valley lying between our east and west mountain ranges and of the slopes from these to their respective coasts. If we improve these in accordance with a well-defined progressive policy we shall, in conjunction with our great railways and other forms of transportation, keep

apace with the industrial and commercial advancement of our country.

I am not unmindful of the great expenditure of public money which the prosecution of such a policy will entail. The expense of carrying an article from the place where it is to the place where it is wanted must be added to its cost, whether it be in its raw or finished state. Therefore its cheaper carriage results in a saving to that extent. As the cost of transportation by water is about one-sixth of that by rail, a great saving, apportioned between the producer and consumer, and hence among all our people, would follow.

FIG. 4. HARBOR SIDE OF COMPLETED BREAKWATER.

What has been the extent of this saving in cases where the government has brought its waterways to a state of approximate completion? The greatest waterway in the United States, and by far the greatest inland waterway in the world, is composed of the Great Lakes. Up to the close of 1907 our government has expended upon the harbors and connecting channels of these lakes $85,000,000.

We have every justification for the improvement of our waterways upon a sensible and liberal basis. Other countries not so favorably situated in the location and extent of their waterways are far advanced in the solution of these problems. Germany, France, Holland and Belgium have developed at enormous expense large systems of internal waterways. And in Germany at least great extensions are yet contemplated. The producers of the United States have a longer haul to the seaboard than any other country competing for a foreign trade. We must overcome the disadvantage of the longer haul by the lesser freight rate, for which we must look to the waterways, navigable all the year round.

Nor does such a policy of waterways improvement operate disadvantageously to the railways, even though it compels lower freight rates, inconsistent as this statement may seem. In the natural economy of transportation, the bulky raw material, commanding the lower freight charges, falls to the waterway, while the manufactured goods of infinite variety seek the railway.

Some canals and many locks and dams will be required for the control of the waters for navigation; those might and should be so constructed as to develop water power.

Perhaps the greatest influence toward the framing of a broad, comprehensive and progressive policy of river and harbor improvements is being exerted by the National Rivers and Harbors Congress, of which body the Deep Waterway Association is a member.

My own judgment is that every great improvement, like that of the lakes-to-the-gulf, like that of the Ohio River, like that of the Missouri River, like the Atlantic seaboard inland waterways, should be treated by itself as one great enterprise, just as we have treated the Panama Canal, and that provision should be made, by bonds or otherwise, for the setting aside of a fund sufficient to complete it as rapidly as possible.

To leave progress in this matter to the fitful and partisan consideration of appropriation committees in Congress, influenced by a desire to reduce the appearance of total expenditures each year as much as possible, is to impair the necessary financial support of every one of these great enterprises and to drag them along from year to year and greatly to delay their ultimate completion.

A plan should not be adopted until fully confirmed by expert opinion and careful investigation, but when it is adopted, when its utility is made certain, then it is neither economy to the government in the matter of expenditure nor is it a benefit to the people to delay the furnishing as rapidly as it can be economically expended of the full amount of money needed to make the improvement a useful and completed thing.

The Mississippi River, with its great tributaries, drains an empire vastly greater in all the resources of nature than those who accomplished the acquisition of that mighty stream and the territory beyond it ever dreamed of. The Ohio River, one of its largest affluents, itself a thousand miles in length, drains a territory as large as the German empire and will, when improved to its proposed depth of 9 ft., bring into connection with the Gulf of Mexico one of the greatest manufacturing districts of the country and a section rich in the varied products of man's industry and ingenuity. The Missouri River flows through agricultural districts of unexcelled productiveness and all have their tributaries of greater or lesser usefulness and importance.

The improvement of all these so as to make them serve the best purposes of navigation must be ultimately accomplished. The problems of their improvement are somewhat difficult, even intricate, though not insurmountable.

The achievement of these great ends cannot, however, be worked out through Congress without a radical departure from the course of procedure heretofore employed. No projects should be approved without the most careful consideration as to their feasibility and usefulness. When the execution of an approved project has once been determined on it should be carried to completion as rapidly as possible, so that the people's investment may be made to bring returns at earliest possible moment.

During my term as Secretary of War I had occasion to appoint, under the provisions of an act of Congress, a board of engineers to examine and report upon the Ohio River improvements, both upon a 6-ft. and 9-ft. basis, and upon its feasibility and navigability. The board, after a thorough examination, unqualifiedly reported that the improvement be made to a depth of 9 ft. One-fifth of the work had been done under previous reports and approvals, but the rate of progress was such that half a century would not see its completion.

A policy which brooks such delay is wasteful, if nothing worse. Some steps toward a new departure in river and harbor appropriations are apparent in the Rivers and Harbors Bill passed by the 59th Congress, wherein provision is made for the completion of a much larger proportion of projects than in any previous measure.

ADDRESS BY MR. BRYAN.

They said at St. Louis that they wanted a waterway from the lakes to the gulf 14 ft. deep. That is not deep enough. They are now talking about 22 ft. I think it ought to be 23 ft. You cannot give the people too good facilities for the transportation of their merchandise.

You tell me you want to improve the Mississippi. I will help you improve it just as far as you please and make the canals as wide as you please and as deep as you please. And when you get to improving the Mississippi I will start out all alone if necessary to improve every river that empties into the Mississippi.

The railway cannot rival the water course in cheapness, and then there is another advantage that the water course has. When you finish a river sufficiently deep for commerce, or a canal upon which boats can float, you make it possible for a man with small capital to act, while the railways make it possible for men with large capital to act.

I am glad to encourage Illinois in the building of the canal which is proposed in this State. As all parties have indorsed it I will not be accused of partisanship in mentioning it. Let Illinois build it, and if in the building of it she can get lighting power that will pay interest on the cost of it, so much the better for Illinois. Let every State do everything it can and will and let the United States do everything else that the State does not do or cannot do, and let 80,000,000 people have the benefit of state and national activity in behalf of the cooperation of all.

I believe that the plan should be commenced now. I believe that it should be a comprehensive plan, that it should deal with the entire subject and that it should be a permanent plan. That we should begin now to lay the foundation for the future greatness of this country in the development of these natural resources. Ask me how much ought to be spent, I repeat that when every dollar spent brings a large rate of interest, I would give the benefit of the doubt to expenditure rather than to non-expenditure.

I believe in improving the waterways everywhere, no matter whether those waterways are the rivers that run down the mountain sides into the ocean on the East and the West, or the waterways that converge in the Mississippi Valley and carry their floods to the gulf. I believe that it is the duty of those charged with the business of government to develop these things upon which a nation's prosperity depends.

There is a difference between expenditure for the establishment of a money-earning plant and an expenditure that brings no return to the people. If you establish a water plant in a city, that water plant earns an income because it furnishes the people something that the people need. And the city can afford to go into debt and establish something that will bring an income large enough to pay the interest on the debt and to retire the money borrowed when the debt was created. It is a business transaction that can be defended.

You do not measure a nation by its debt; you measure it by the amount that its assets exceed its liabilities. A nation like ours with a large debt is infinitely richer than a small nation with no debt at all.

I am not going to discuss how the money that is used in this development is to be raised. I regard that as a very secondary question. The first question is: Should the work be done? If the work should be done, and I believe it should, then you people who believe it should be done agree upon the best method by which to do it. But I repeat that you must not be frightened because it may require an investment.

At St. Louis last fall they resolved that $500,000,000 spent in improving the waterways of the Mississippi Valley would bring an interest in the way of decreased cost of transportation amounting to $180,000,000 a year. If that is true, it is usurious interest on the investment. But it is not interest collected from anybody, but interest saved.

The only other addresses on the program were as follows: "What Europe is Doing with Waterways," by Mr. John A. Ockerson, M. Am. Soc. C. E.; "Waterways and the Conservation Movement," by Mr. Gifford Pinchot; and "The Future of Rail and River Transportation," by Mr. T. P. Shonts. A considerable amount of the time at the meetings was devoted to short speeches by various delegates. Two subjects that came up for consideration were the Illinois deep waterway and the Missouri River improvement. A local association last year started a steamboat line between Kansas City and St. Louis, and the results were so satisfactory that it has been decided to build boats of lighter draft and broader beam in order to extend the period of navigation. These boats will carry 1,000 tons of freight. The cost of securing a 12-ft. channel between these cities is estimated at $20,000,000; with $20,000,000 more if it is extended to Sioux City, Ia.

In Illinois, the people will vote in December upon a project for issuing $20,000,000 in bonds for a waterway extending from the Chicago Drainage Canal to the Illinois River. This would be 14 ft. deep, but the locks would be 24 ft. deep to provide for future ship traffic. These locks would be 80 × 800 ft. The Internal Improvement

Commission of Illinois estimates the cost at $18,260,000, including four water-power plants which would be productive of revenue.

The following is a summary of the official resolutions adopted:

Easy and adequate transportation, effective between producer and consumer and for carrying the abundant product of the country to the seaboard for shipment abroad, is the first essential for the development of the commerce of the United States. The responsibility for this development rests on the general government.

It has been demonstrated during the past ten years that when business conditions in the United States are normal the transportation facilities afforded by the railways are utterly inadequate, and it is stated by the great traffic managers of the railways that the development of railway facilities cannot keep pace with the increased demands upon them. The leading railway authorities, including prominent officials of all the great lines which parallel the Mississippi, declare that water transportation must be developed to supplement the railways in order that the freight of the country may be handled properly and promptly.

Under the Constitution the regulation of commerce between the States devolves on the general government. The control of waterways and the regulation of navigation also rests with the general government, and neither States nor private capital can be permitted under the Constitution to assume these duties.

The duty, therefore, devolves on the general government to give to the country adequate transportation facilities by developing the navigable waterways of the country into complete freight-carrying usefulness. This duty should be recognized by the Congress at once, and the waterways should be made efficient freight carriers. In no other way can this country derive benefits equaling those of other countries from the building of the Panama Canal.

If it be found that the current revenues of the government are insufficient for carrying out vigorously and on a broad plan the development of our waterways, the Congress should secure funds for that purpose by providing a sufficient bond issue.

The interior valley comprises approximately half the area of the United States. It is 2,500 miles in length and 2,000 miles in width. The arms of this great river system from the boundary lines of 21 States and over 20,000 miles of possible navigation. This vast valley produced three-fourths of our foreign exports. Within this valley live half the people of the entire United States. The opening of a deep channel way connecting the Great Lakes on the north with the Gulf of Mexico on the south is therefor an imperative duty of the general government, and this work should be immediately begun and completed as speedily as possible.

Any plan for the inland waterway development so imperatively necessary to the material welfare of the valley should comprise a main trunk line in the form of a strait connecting Lake Michigan with the Gulf of Mexico by way of the Illinois and Mississippi rivers. The development of this trunk line should begin at once. The improvement of the branches of this main line, such as the upper Mississippi with its tributaries, the Ohio with its leading tributaries, including the Tennessee and Cumberland; the Missouri, the Arkansas, the Red, the White and other rivers, and the interstate inland waterway of Louisiana and Texas, should proceed simultaneously with the development of the principal line.

The deep waterway is practically complete from Chicago to Joliet through the courage and enterprise of the single city of Chicago, which has by the expenditure of $55,000,000 created a deep waterway across the main divide between the waters of Lake Michigan and those of the Mississippi. A special board of survey, composed of United States engineers, reported to Congress in 1905 that the continuation of the deep waterway from Joliet to St. Louis was feasible, and would cost only $31,000,000. The State of Illinois, assuming that the Federal Government will take the responsibility of completing the waterway to the gulf, is about to cooperate to the extent of $20,000,000.

A special board of United States engineers was, through the efforts of this association, created by Congress last year to survey the deep waterway route from St. Louis to the mouth of the Ohio, and to report to Congress the feasibility and cost of the waterway. That board will report during the winter, and we demand that when this report is made, Congress shall at once provide funds sufficient to begin operations in a large and effective way.

The broad plan for improving all the waterways for navigation should take account of all other uses of waters and benefits to be derived from them by the people; should consider the conservation of the natural resources of the country in their relation to commerce and navigation; should extend to forest preservation, reservoirs and other means of stream control, and the maintenance of the level of our Great Lakes in such a manner as not to interfere with their navigation and commerce; should consider floods and their prevention, together with irrigation and drainage; should take account of bank revetment, levee building and other means of protecting the bottom lands and increasing their productivity, and should contemplate regulation of terminals with a view to rendering rail transportation and water transportation complementary and jointly useful to the people of the country.

This convention is in hearty accord with the movement for the conservation of the natural resources of the country and heartily approves the efforts of the National Rivers and Harbors Congress in seeking to develop the waterways of the nation.

The officers elected are as follows: President, Wm. K. Kavanaugh; Secretary, William F. Saunders, St. Louis, Mo. The next meeting will be held at New Orleans in 1909.

THE GERMAN STEAMER "NIPPONIA" was struck by the "Pretoria" of the Hamburg-American Line off Scheveningen, Netherlands, Oct. 10. The captain of the "Nipponia" and twelve of her crew were drowned. The "Pretoria" was little damaged.

A GRAIN ELEVATOR EXPLODED at Richford, Vt., Oct. 7, killing 15 workmen in the elevator and 2 women who were walking on the tracks near the building. The explosion is ascribed to accidental or spontaneous ignition of grain dust. The corrugated iron roof was blown off and portions of it were carried more than a quarter of a mile away from the building. Several freight cars near the elevator were broken up and overturned. The fire which followed completely destroyed the elevator and adjoining power-house, a flour warehouse and 75 freight cars. The elevator was jointly owned by the Canadian Pacific Ry. and the Boston & Maine R. R., and was leased by them to the Quaker Oats Co. The loss is estimated at $400,000.

WORK TRAINS have figured prominently in collisions this month. A work train on the Pennsylvania R. R. at Washingtonboro, Pa., Oct. 6, was stopped on a bridge over a small stream emptying into the Susquehanna River. A dense fog concealed this train from an approaching freight which struck the rear car, killing one man and injuring seven others.

On the same date, a work train on the Grand Trunk Ry. collided with a yard engine two miles east of Burford, Ont. Three men were killed and two others injured. This wreck is ascribed to a violation of the company's rules.

A head-on collision between a work car and a passenger car took place on the line of the Bridgeton & Millville Traction Co.'s line four miles west of Millville, N. J., Oct. 8. The work car, which should have been on a siding was occupying the main track when the passenger car crashed into it. Four men were injured.

A special car carrying a gang of laborers on the Boston & Northern Ry. telescoped a regular passenger car in the Bradford district of Haverhill, Mass., Oct. 9. The accident occurred just south of the bridge over the Merrimac River. It is said that the conductor and motorman of the special either did not notice or disregarded a signal, and tried to reach a switch beyond the bridge ahead of the north-bound car. One man was killed and 20 others injured.

Including the accident noted in our issue of last week, there have been reported since the first of this month a total of five work-train and work-car collisions, killing 8 men and injuring 40.

TWO WRECKS CAUSED BY YARD ENGINES have been reported during the past week.

A freight locomotive drawing three cars along the tracks of the Pennsylvania R. R. near Newark, N. J., Oct. 10, crashed into a drill engine which had been brought to a standstill with its headlight turned away from the approaching freight. Both locomotives were wrecked and one fireman fatally injured.

The second accident occurred in the yards of the New York Central lines at Black Rock, near Buffalo, N. Y., Oct. 12. A switch engine and a freight train came together at the junction of the Niagara Falls line and a siding, ditching both engines and overturning several cars. Before a flagman could be sent back, a Michigan Central passenger train crashed into the wreckage, but escaped derailment. The engineer of the switch engine was seriously injured.

THE WRECK OF A PASSENGER TRAIN on the Chicago, Rock Island & Pacific Ry., at Yukon, Okla., Oct. 8, resulted in the injury of 25 passengers. The train was standing at the station when a freight train, which was waiting on a siding, became unmanageable owing to an accident to the air brakes and ran out upon the main track, striking the passenger train near the middle. Four coaches were overturned.

AN EXPRESS CAR COLLISION, Oct. 8, on the Lewiston branch of the Lewiston, Augusta & Waterville electric railway, near Lisbon, Me., demolished both cars and injured four members of their crews. [illegible] cars met at full speed on a sharp curve. The accident was caused by a motorman's failure to obey orders.

A HUDSON RIVER BRIDGE SCHEME on which the joint commission of New Jersey and New [illegible] is now working provides for crossing the river at Washington, about 181st St., New York. At this point both shores are high rock bluffs and the river is such that it has been claimed that a 1,400-ft. span could be obtained. This location is about six miles south of any previously proposed crossing of the Hudson River, and reaches no traffic centers on either the New York or the New Jersey side. Mr. McDougall, one of the New York members of the commission, has advanced a project for a bridge at this site, crossing a 1,400-ft. cantilever span over the New York deepest half of the channel, and three 640-ft. simple spans over the shallower west half. The cost of approaches, it is said, would be much lower for this location than for any more southerly one, but extensive traffic connections on both shores would be required, which would probably make up the saving.

WILBUR WRIGHT, on Oct. 6, established a new record for aeroplane flight with a single passenger beside the operator. At Le Mans, France, he made a flight of 1 hr., 4 min., 26 sec. His best previous performance was 55 min., 37 sec. It is reported that by the last flight made Mr. Wright has fulfilled the requirements of a French syndicate which has acquired the patent rights for making this type of aerial flyer in France and colonies. It is also reported that the Wright brothers received $100,000 for these rights and that 50 machines will be built immediately.

FOUR FLYING MACHINES are called for in invitations for bids sent out from the Navy Department. The invitations specify machines to be wholly supported without the aid of a gas bag; to carry two people, one of whom shall be an observer only, together with sufficient fuel for a 200-mile trip, for four hours of continuous flight at an average speed of 40 mi. per hr.; to be so constructed as to alight without damage on land or water, to float on the latter without wetting its supporting or control planes and to arise therefrom, without delay, under its own power without special starting devices. It is further required that the first machine shall be delivered at the U. S. Naval Academy, Annapolis, Md., within five months after completing the contract and that the remaining ones shall be delivered within eight months. It is required that all bids must be accompanied by specifications and plans, showing in detail what it is proposed to furnish, and by a guarantee of responsibility for the use of patented devices.

It is currently reported that this invitation for bids is ineffective because of an announcement that the Secretary of the Navy would refuse to approve such purchases until an appropriation was made by Congress. It is stated that the department has no money available for this purpose and that no funds may be diverted from the specific purpose for which they were appropriated.

THE FREIGHT-CAR SITUATION on Sept. 30, as reported by the Committee on Car Efficiency of the American Railway Association, shows that the rate of improvement which has prevailed for two months is still maintained. The total of surplus cars on Sept. 30 was 133,792 (against 173,587 two weeks before) which is a decrease of 40,000 in two weeks (against 49,000 in the preceding two weeks). The idle box cars are now 42,593, a decrease of 16,000, while coal, gondola and hopper cars number 49,705, a decrease of 17,000. In the month of September a perceptible shortage of cars, mainly of box cars, developed on the western Canadian and northwestern American lines. The shortages reported for Sept. 30 aggregate 8,114 cars, of which 7,313 were box cars. The shortage is attributed to the grain movement and is expected to be only temporary.

THE ROOSEVELT DAM, forming a part of the Salt River Irrigation Project, U. S. Reclamation Service, had reached a maximum height of 118 ft. above the foundation at the close of September. The lowest point in the structure on the date named was 87 ft. above the foundation. A total of 14,800 cu. yds. of masonry was laid during September, which exceeded by 1,000 cu. yds. the record of any previous month. The cement mill produced 12,200 bbls. of clinker during the month, and supplied all the cement needed on the construction work.

A JOINT TRUNK OUTLET SEWER for Plainfield, North Plainfield, Dunellen, Bound Brook and East Bound Brook, and also possibly for Somerville and Raritan, is under consideration by a committee representing the communities concerned. Mr. Joseph O. Osgood, M. Am. Soc. C. E., of Plainfield, N. J., is chairman of the engineering committee of the general committee. Hering & Fuller, 170 Broadway, New York City, have been chosen as engineers to make a preliminary survey and report.

TWO CHINESE COMMISSIONERS have been sent by the government to investigate the question of railway administration in the United States. The results of their investigation will be considered in determining the administration of railways in China. The commissioners, Chentu and Wuhsun, sailed from Shanghai for San Francisco, Sept. 24.

THE MANZANILLO EXTENSION OF THE MEXICAN Central Ry. is practically finished, only some minor bridge and yard structures remaining to be completed. This line makes a through route from City of Mexico to the Pacific, and in connection with the new Tampico short line of the same railway company gives a direct all-rail route from Tampico on the Gulf of Mexico to Manzanillo on the Pacific. The new work is 42 miles long, from Tuxpan to Colima. The 59 miles from Colima to Manzanillo was already covered by a narrow-gage railway built two decades ago, and this required to be rebuilt. The Mexican government has built large harbor works at Manzanillo. Hampson & Smith, of Mexico, were the contractors for the Tuxpan-Colima line; they began work in spring, 1905. The line was described in our issue of April 4, 1907, p. 376 (the map accompanying that article contains an error in showing Tuxpan to the north of Zapotlan instead of 17 miles south of that point).

NAVIGATION ON THE MISSOURI RIVER between Kansas City, Mo., and St. Louis, was established in 1907 by the Kansas City Transportation & Steamship Co., the company being organized for the purpose of demonstrating that the river was navigable by steamboats carrying sufficient freight to render operation profitable. The two steamers carried freight at about 66% of the railway rates, and made a profit for the season. The difficulties of navigation due to bars in the channel became pronounced as early as August. Without waiting for the desired river improvement, however, the company has determined to build boats of lighter draft and broader beam. These will carry 1,000 tons of freight at a good stage of water and 500 to 600 tons at low water. The government has appropriated funds for operating snag boats on the river. Surveys have been made for a 12-ft. channel, and the cost of obtaining such a channel from St. Louis to Sioux City is estimated at $40,000,000, or $20,000,000 from St. Louis to Kansas City, 390 miles. From 1892 to 1896, Congress made appropriations in aid of improving the river for a 6-ft. channel, but it is said that no appropriations have been made since 1896, as the river had come to be considered impracticable for navigation. The Missouri Valley River Improvement Association is working to secure appropriations for improving the river with a view to a 12-ft. channel, at least between St. Louis and Kansas City.

THE ILLINOIS DEEP WATERWAY has been reported upon by the Internal Improvement Commission of Illinois, and provides for connecting the Chicago drainage canal with the Illinois River at La Salle. Beyond this the development would be left to the federal government. The total length (including the 36 miles of river and canal from Lake Michigan to Lockport) would be about 100 miles. The locks would be 800 × 80 ft., with 24 ft. of water over the sills. The longest stretches of the waterway are wide and deep pools formed by the dams, but where new channels are necessary a width of 300 ft. is proposed, with a depth of 14 ft.; the depth would be increased to 24 ft. when necessary. Four water-power plants are planned, aggregating 140,000 HP. The net salable power is taken as 100,000 HP., and a rental of $25 per HP. per year is assumed, in excess of operating expenses. The cost is estimated as follows: 14-ft. waterway and 24-ft. locks, $14,319,000; developing water power, $3,600,000; right-of-way, $340,000; total, $18,259,000. It is estimated that the work could be completed in five or six years.

At the election in November, the people of Illinois will vote on a proposed amendment to the state constitution which provides for an issue of $20,000,000 in bonds to carry out this work. The members of the commission are Isham Randolph, M. Am. Soc. C. E. (Chairman), H. W. Johnson and H. M. Schmoldt.

SEVENTEEN ELECTRIC PUMPING PLANTS, to supply water for irrigation, are to be installed by the United States Sugar & Land Co., of Garden City, Kan., according to the U. S. "Reclamation Record." The pumping stations will be located south of the Arkansas River, near Deerfield and Lakin, Kan., and will be similar to those installed by the Reclamation Service on its Garden City Project. The high-voltage electric current for operating the 17 stations will be transmitted from the company's sugar factory at Garden City, the distance ranging from 18 to 26 miles. The water supply will be drawn from wells.

FORTY STEEL CARS, for use on the elevated division of the Philadelphia Rapid Transit Co., were added to the car equipment of that company during the year 1907-08.

CARS WITH THREE TRUCKS have been introduced by the Great Northern Ry., of England. This design is for the purpose of adapting the old type of car with rigid axles to the more modern system (in Europe) of supporting cars on trucks. Each car consists of two old three-axle passenger cars. The running gear is all removed, and a truck placed under each end of the converted car. The third truck supports the inner or adjacent ends of the two independent underframes. This arrangement has been carried out by Mr. H. N. Gresley, Mechanical Engineer of the Great Northern Ry.

STORAGE BATTERY MOTOR CARS have been ordered by the Prussian State Railways from the Allgemeine Elektricitäts Gesellschaft, the Siemens-Schuckert Works, and the Felten & Guilleaume-Lahmeyer Works, 19 two-car units being ordered from each firm. A unit consists of two four-wheel cars coupled close, equipped with 168 cells (84 per car) and two 80-HP. motors; the unit will take something over 100 passengers. A distance of 60 mi. can be run on one charge, and a maximum speed of 30 mi. per hr. can be attained. Trial runs of a sample unit were made on the Berlin-Dresden division a short time ago, the present order being based on the successful outcome of the tests. [Zeitschrift des Vereines deutscher Ingenieure, Sept. 26.]

ELECTRIC TRACTION IS TO BE INSTALLED by the State Railways of Baden (Germany) on the branch lines Basel to Zell (about 20 mi.) and Schopfheim to Säckingen (about 10 mi.). Single-phase alternating current at 15 cycles is to be used, with 10,000 volts on the trolley-wire. Twelve locomotives of 1,000 HP., transformer equipment and line conductor installation have been ordered from German electric manufacturers. The cost is estimated as 1 to 1½ million dollars. The power supply will be obtained from a hydraulic generating plant on the Rhine. [Zeitschrift des Vereines deutscher Eisenbahnverwaltungen, Sept. 16.]

THE ADVISABILITY OF AFFORESTATION in South Wales, England, was recently investigated by a Parliamentary Committee. Sir Joseph Bailey stated before this committee the result of timber-planting experiments, in which he has been engaged for a number of years, and showed that a return of not more than 2½% on the capital invested would be secured. These experiments were made, however, outside of the coal district, in which there are thousands of acres suitable for tree planting where pit timber could be produced for the market close at hand.

AN INTERDEPARTMENTAL STATISTICAL COMMITtee has been created by an executive order issued by President Roosevelt. The order, which includes the names of the committee members, is as follows:

The following-named gentlemen, representing the several executive departments and one independent government establishment, are hereby designated as members of an interdepartmental Statistical Committee hereby created, under the jurisdiction of the Secretary of Commerce and Labor, for the purpose of promoting uniformity of statistical methods and results, preventing duplications, rendering possible closer cooperation, and keeping the statistical work of the government abreast of the most modern methods:

Mr. John Ball Osborne, Chief of the Bureau of Trade Relations, Department of State;

Hon. Lawrence O. Murray, Comptroller of the Currency, Department of the Treasury;

Major John T. Thompson, Assistant, Ordnance Department, Department of War;

Mr. H. C. Gauss, Private Secretary to the Attorney-General, Department of Justice;

Mr. E. T. Bushnell, Chief Clerk to the First Assistant Postmaster-General, Post Office Department;

Mr. F. S. Curtis, Chief Clerk, Department of the Navy;

Mr. Clarence J. Blanchard, Statistician, Reclamation Service, Department of the Interior;

Mr. Victor H. Olmsted, Statistician and Chief, Bureau of Statistics, Department of Agriculture;

Mr. Oscar P. Austin, Chief of Bureau of Statistics, Department of Commerce and Labor; and

Prof. Henry C. Adams, In Charge of Statistics and Accounts, Interstate Commerce Commission.

Hon. Lawrence O. Murray, Comptroller of the Currency, Treasury Department, is hereby designated to act as chairman of this committee.

The specific duties of the committee thus created shall be as follows:

(a) To make recommendations with a view to eliminating unnecessary duplication of work and conflicting results.

(b) To make recommendations with a view of utilizing the statistical material in one branch of government work, with reference to the needs or aims of other branches.

(c) To make recommendations with a view of establishing uniform definitions of statistical terms.

(d) To make recommendations with a view of introducing uniform methods.

(e) To make recommendations in regard to schedules and accompanying instructions relative to any new line of statistical inquiry; to study the needs of the various bureaus and departments from time to time and above all to test the results achieved, and to investigate whether they are in harmony with each other and modern statistical methods and practice.

(f) To make recommendations regarding the preparation and the place of publication of the Statistical Abstract of the United States.

THE FIRST SERIES OF FENDER TESTS instituted by the Public Service Commission of New York, first district, closed Oct. 3 at Schenectady. While no official statement has been made, it is currently reported that of the 35 devices tested on the experimental track of the General Electric Co., none was entirely satisfactory. A second series of similar tests will be started on the grounds of the Westinghouse companies at Pittsburg, Oct. 20. This series is to accommodate Western manufacturers.

THE FRANKLIN UNION, a mechanics' trade school, was opened in Boston, Mass., Sept. 25, by the dedication of the building. As noted in Engineering News, March 28, 1907, this school was made possible by a fund provided by Benjamin Franklin in 1791, which became available in 1906. This fund was doubled by Andrew Carnegie. It is reported that applications for admission to courses are already nearly equal to the accommodations.

PERSONALS.

Mr. Shelman B. Brown, General Manager of the Maryland Electric Rys. Co., has resigned.

Mr. H. L. Weber, Chief Engineer of the Fort Wayne & Wabash Valley Traction Co., resigned Oct. 13.

Mr. W. C. Miller has been appointed Superintendent of the Canadian Pacific Ry. with headquarters at Winnipeg, Man.

Mr. Cornelius Burke has been appointed Commissioner of Sewers in Queens Borough, New York City, succeeding Mr. John J. Halleran.

Mr. F. G. Pettibone, Vice-President and General Manager of the Gulf, Colorado & Santa Fe Ry., has been elected President of the Houston Belt & Terminal Ry.

Mr. John P. Klug has been elected President of the Burlington Interurban Ry., under construction from Hudson to Greeley and Fort Collins, Colo., succeeding Mr. F. O. Olson.

Mr. R. R. Jamieson, General Superintendent of the Central Division of the Canadian Pacific Ry., has resigned and has accepted a position with a private enterprise at Calgary, Alta.

Mr. B. A. Behrend, Chief Electrical Engineer of the Allis-Chalmers Co., Milwaukee, Wis., has severed his connection with that company. Mr. David Hall, Chief Designer of Direct-Current Apparatus, and Mr. Allan Field, Chief Designer of Alternating-Current Apparatus, have resigned also.

The following appointments are announced in a recent issue of the "Reclamation Record": Mr. C. P. Williams, M. Am. Soc. C. E., has been appointed Engineer-in-Charge of the Huntley Project in Montana. He is assigned the duties of Acting Supervising Engineer to take action in matters requiring immediate attention in the absence of the Supervising Engineer.

Mr. R. S. Stockton is to act as Irrigation Manager of the Lower Yellowstone Project.

Mr. C. H. Paul, Assoc. M. Am. Soc. C. E., will have charge of the Lower Yellowstone Project under the title of Acting Project Engineer.

Obituary.

Charles M. Doolittle, Assistant Manager of the Iroquois Pulp & Paper Co., of Thompsons, N. Y., died of lockjaw Oct. 10.

ENGINEERING SOCIETIES.

COMING MEETINGS.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 20-22. Annual convention at Washington, D. C. Secy., S. F. Patterson, Boston & Maine Ry., Concord, N. H.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 20-23. Annual meeting at Atlantic City, N. J. Secy., A. P. Folwell, 239 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Oct. 21-23. Annual meeting at New York City. Asst. Secy., W. Bissell, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Oct. 30-31. Fall meeting at New York City. Secy., Dr. J. W. Richards, Bethlehem, Pa.

ROADMASTERS AND MAINTENANCE-OF-WAY ASSOCIATION OF AMERICA.
Nov. 10-12. Annual meeting at Milwaukee, Wis. Secy., W. E. Emery, West Chicago, Ill.

AMERICAN RAILWAY ASSOCIATION.
Nov. 18. Annual meeting at Chicago, Ill. Secy., W. F. Allen, 24 Park Pl., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 19-20. Annual meeting at New York City. Secy., W. J. Baxter, 29 West 39th St., New York City.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Nov. 30-Dec. 1. Annual meeting at New York City. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 1-4. Annual meeting at New York City. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 15-17. Annual convention at Washington, D. C. Secy., Glenn Brown, "The Octagon," Washington, D. C.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.—The 15th annual meeting will be held in the Engineering Societies Building in New York City Jan. 19-21.

THE MUNICIPAL ENGINEERS OF THE CITY OF NEW YORK.—There will be an excursion Oct. 17 to the Croton Falls reservoir, near Brewster, N. Y., which is now in an active stage of construction. The party will ride in a special car over the 20 miles of construction tracks of the contractors.

NEW YORK RAILROAD CLUB.—A meeting will be held Friday evening, Oct. 16, in the Engineering Societies' Building. A paper entitled "Heat Accumulators in Steam Engineering," by Mr. L. Battu, President of the Rateau Steam Regenerator Co., will be presented. The Secretary's offices are now at 607-08, No. 95 Liberty St., New York.

NORTHWESTERN CEMENT PRODUCTS ASSOCIATION.—The fifth annual convention will be held March 2-4, 1909. The place for the convention has not yet been determined. The Association has decided to present a concrete building to be used solely for cement products exhibits to the Minnesota State Fair, and committees have been appointed to select a site and prepare the plans.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—At the annual New York meeting, Dec. 1-4, one session will be devoted to machine-shop practice. Papers will be presented at this session on new developments in milling machines and cutting tools and on gear tooth standards. At the Professional Session on Dec. 2, a paper will be presented by Major Geo. O. Squier, Acting Signal Officer, U. S. A., Washington, D. C., treating exhaustively the problems of aviation and pointing out how the engineer can help in their solution. Major Squier has at his disposal for the preparation of this paper the reports of the attachés at the capitals of the world. On the evening of the same day, Lieut. Frank P. Lahm of the Signal Corps will deliver a popular lecture on the same subject with moving pictures.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At a meeting of the society in New York City, Oct. 7, Mr. O. S. Lyford, Jr., of Westinghouse, Church, Kerr & Co., presented a paper entitled "Catenary Trolley Construction." This paper was entirely a description of the construction employed in the electrification of the Denver & Interurban R. R., running from Denver to Boulder, Colorado. This system employs single-phase alternating current at 11,000 volts except at the terminals where change is made to 600-volt direct current for greater safety. There are 44 miles of single-phase construction and 1⅛ miles of 600-volt trolley line in Boulder. In Denver the cars are operated over the lines of the Denver Tramways Co. Throughout the paper Mr. Lyford described the special arrangements of the work trains necessary to secure rapid action and to prevent interference with the regular steam traffic.

A single messenger-cable catenary line was supported by bracket arms from wooden poles, spaced 8 ft. 6 ins. from the track centre. The poles were set by derricks mounted on flat cars. In placing brackets the work train was split up into several sections, one car at each pole. The men worked from collapsible platforms mounted on the top of freight cars. Along the top of the poles was strung a steel cable acting as a ground wire. Ground connection was made with this to the track at every fifth pole. This scheme was adopted as being cheaper than grounding each bracket and in the hope of serving as a lighting protector. The trolley wire was of "phono-electric" alloy instead of copper to secure the necessary strength at low cost. It was considered that the lower conductivity was compensated by such other advantages. The wire was hung so that temperature drops were taken care of by increased stresses in the wire. Splices and dead ends were made with soldered splicing sleeves.

It was stated at the end of the paper that 11,000-volt catenary construction on wooden poles with conductors to allow half-hourly operation of two-car trains cost from $3,500 to $5,000 per mile. The discussion on the paper was largely a comparison of other single-phase construction particularly of light steel work for places where poles might have been used.

At this meeting the ballots on the two amendments to the constitution were counted. Amendment A, changing the method of electing members of the society was adopted by a vote of 892 for to 317 against; votes necessary for adoption, 806. By this amendment the election of members is taken from the corporate members where it was formerly vested and put in the hands of the Board of Direction, normally 32 in number. Of these 32 there will have to be 25 votes cast to validate an election and three or more negative votes will exclude from election. Formerly, 20 or more negative votes out of the entire membership of the society were sufficient to exclude. As in the past, the society will issue lists of applicants, concerning whose qualifications members are supposed to inform the Board of Direction. Amendment B, passed by 1123 for, 58 against, 788 necessary for adoption, simplifies the appointment of special committees which heretofore was hedged about with considerable red tape.

WESTERN SOCIETY OF ENGINEERS.—At the meeting on Oct. 7, Mr. L. R. Stowe presented a paper on "Methods of Studying the Heat-Absorbing Properties of Steam Boilers." The point of view taken by the author is well explained by the following quotation from his introductory remarks:

> There is no subject in the broad scope of mechanical engineering that has progressed as slowly as that of boiler design, where thermal efficiency is to be considered. The problem of arranging heating surface so that it will absorb the highest percentage of the heat presented to it is one that is little understood. The boiler purchaser can easily enough make his choice when strength, maintenance and the like are considered, but when he has to consider fuel economy it is doubtful if he can, with authority, say which boiler is the most efficient. It seems strange that this subject of the transfer of heat from gases to water has not been attacked in a more serious manner, when we consider that since the introduction of steam for power, the boiler has played the most important part in the field of mechanical engineering.

The purpose of the author was to show that if special care is taken to secure complete and accurate information when tests are made of steam boilers it will be possible (by going beyond the usual calculations) to arrive at more definite knowledge of the subject of thermal efficiency of boilers. The paper was mainly of a mathematical character. It dealt first with the individual efficiencies of the grate, furnace and boiler, and then with the combined efficiency of boiler and furnace. In addition to the mathematical calculations, charts were presented, giving curves of constant capacity under varying conditions.

In a written discussion, Mr. W. T. Ray suggested that it is impossible in calculations based on boiler tests to separate (even approximately) the heat absorbed by radiation and conduction from that absorbed by convection. For instance, how can it be determined whether cross-baffling a boiler of the parallel flow type causes it to absorb more or less heat from the gases at any and all rates of working. Mr. Ray, however, suggested a method of determination which has been tried experimentally but is not yet fully developed. It is based upon the ideas of Prof. John Perry, and is a test for heat absorbed by convection only, independent of radiation or conduction. Mr. R. H. Kuss remarked that more attention should be given to the consideration of the boiler and the furnace separately. The latter is the more changeable factor, although in the past the tendency has been to attribute to the boiler all differences in the results of several trials.

A visit to the great steel plant now under construction by the Indiana Steel Co. at Gary, Ind., was made by a party of about 150 members of the Society on Oct. 8. The works are of great size and extent, and of most substantial construction, being built entirely of steel, brick and concrete. Three special cars were attached to a regular train on the Lake Shore & Michigan Southern Ry. On arrival, the party viewed the track elevation work and the concrete-floored bridges carrying the several railways over the streets. After a short walk through the main street of this new industrial town, dinner was served in one of the boarding hotels of the steel company.

Several parties were then organized for a trip through the works, each being under the direction of one official, who acted as guide. No part of the plant is ready for steel making, but the ore-handling machines are building the stock piles, and the machine and boiler shops are at work on equipment for the plant. The immense line of soaking pits is completed, and the rail and billet mills are practically complete. The 6,000-HP. electric motors which will be directly connected to the roll trains are under erection. Beyond this part of the plant are the open-hearth furnace buildings, of which there will be four. Beyond these again are the gas plant, two large buildings with the horizontal blowing engines, each operated by a gas-engine working on blast-furnace gas. Near these will be a row of eight blast furnaces, close to the canal in which the ore steamers enter from the lake. Here there are five Hulett ore unloading machines, with the stock piles and ore-handling bridges behind them, lying between the canal and the blast furnaces.

An extensive system of railway tracks has been laid through the works by the Chicago, Lake Shore & Eastern Ry. Near the entrance to the works is a handsome office building. The canal mentioned above opens directly to the lake, and is protected temporarily by bulkheads extending partly across it. Contracts amounting to nearly $1,000,000 have been awarded for a breakwater and other protective works at the mouth of the canal.

Some of the members went to Indiana Harbor to see the series of Strobel bascule bridges which has been built to carry the several railways over the ship canal at that place, about six miles from Gary. Another party visited the 6-ft. intake tunnel of the Gary water-works system. The tunnel extends about 7,500 ft. under the lake to an intake crib, and about 7,500 ft. inland to the city pumping station. The work is mainly in clay. Some particulars of this water supply system were given in our issue of Nov. 7, 1907.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the New York meeting held on the evening of Friday, Oct. 9, a paper entitled "High Potential Underground Transmission," was presented by Messrs. P. Junkersfeld and E. O. Schweitzer. The [illegible] described the 9,000-volt and 20,000-volt three-phase cable mains of the Commonwealth Edison Co., of Chicago, Ill., which supply respectively the inner district (within 10-mi. radius) and the outer district. The 9,000-volt cable lines, supplying 44 converter substations, aggregate 272 miles in length; the 20,000-volt cable, [illegible] from the 9,000-volt system, is 11 miles long. Additions now under construction will bring these amounts up to 310 and 55 miles. All these are three-core, paper-insulated cables laid in tile conduit. The current is at 25 cycles. The two power stations of the system have an aggregate capacity of 118,000 KW. In 5½ years 44 burnouts occurred on the cables, 25 of them being due to external causes and only 19 to the cable itself. "The most frequent sources of trouble are from without, and of these electrolysis is apparently the most persistent."

A series of oscillograph and spark-gap studies was made on the cables, the former to observe the effects of switching, etc., in causing potential rises, and the latter to learn the frequency of supernormal voltages at different points of the network. The observations are described and discussed at some length, with the following general conclusions: Pressure-rises of more than 100% occur occasionally on the 20,000-volt line, and also, though far more rarely, on the 9,000-volt lines; in neither case are they chargeable to switching, so far as the oscillograms show. The observations will be continued after the extension of the 20,000-volt line is completed.

Mr. Charles H. Merz (London, England), in a transmitted discussion contrasted the conduit draw-in system of cable laying, used in America, with the "solid system" of placing cables in earthenware troughing and filling with asphalt, and with the use of armored cable. He believes that one of the two latter systems may be found advantageous in this country in outlying or country districts, where the objection to frequent opening of pavement does not exist. Lower cost, and in the case of the solid system the protection against moisture, were urged as great advantages. A more advantageous network can be obtained by laying cables along a number of routes, than by grouping many cables in one set of ducts, as must be done for economy with the conduit system. He claims that the most economical cable is one of 0.10 to 0.15 sq. in. conductor, and believes that the voltage should be chosen high enough to permit making this the unit. Mr. H. W. Fisher (Pittsburg, Pa.), objected that asphalt-filled troughs are not a complete protection against moisture; he has seen long lengths of cable so laid that were destroyed by the action of moisture. For a high-pressure test of cables, he suggested 2½ times the working voltage, held for five minutes, as more in keeping with general practice than the authors' double-potential tests. He also laid stress on the importance of good design and careful workmanship in making joints, a point later emphasized by Mr. Alex Dow (Detroit), who described at length the trouble history of two 23,000-volt cables at Detroit. Mr. H. G. Stott (New York City), then referred to the cables of the Manhattan Ry. and the Interborough (subway) cables in New York City. In 1902-1908 inclusive, these had 43 failures, or an average of between 6 and 7 per year, the system now having about 370 miles of cable. Referring to Mr. Merz's remarks, he said, that there is a vital difference between a system of a few thousand kilowatts and one of a hundred thousand kilowatts; an arrangement which is perfect in the former may be fatally troublesome in the latter. He then said that power networks cannot go on increasing in connected power as they have in the past, for even with the large power networks of the present a failure may be such as to make all protection devices inoperative. On the Interborough system it is possible to have 300,000 KW. concentrated on a short circuit, and in this condition relays and the like are of no use. A new development, the induction generator, may prove able to give relief, but the piling up of power in synchronous machinery cannot go farther.

Mr. E. J. Berg, Mr. Wallace Clark and others also spoke on the paper. Mr. Clark expressed his disbelief in frequent high-pressure testing, on the ground that it shows little and does the cable no particular good. The one form of test that he believes is well worth more frequent use is the test for electrolysis; it is able to save many burnouts. While cables can be made commercially for 25,000 volts, he remarked, the 20,000-25,000-volt cables in use today are working at a lower factor of safety than the more common 11,000-volt cables. Mr. Stott had spoken of some cables at Buffalo that are now 17 years old and are still in use; Mr. Clark remarked that there are 11,000-volt cables in Buffalo that are 10 years old, the oldest of this voltage. These are all rubber-insulated cables, however, and do not depend on the integrity of the lead sheath for their existence as do paper-insulated cables. He does not know the life of a lead sheath.

ENGINEERING LITERATURE

Supplement to ENGINEERING NEWS. 220 Broadway, New York, October 15, 1908.

CONTENTS.

REVIEWS:
The King's Highway—Australasian Roads—Road Preservation and Dust Prevention—Dust Preventives—Highway Engineering—Road Locating and Building Simplified. Reviewed by S. Whinery 427
Handbuch der Ingenieurwissenschaften—Lehrbuch des Hochbaues—Lehrbuch des Tiefbaues..... 428
Telephone Construction 429
[illegible] 429
Electrical Contracting 429
How to Build up Furnace Efficiency..... 429
Structural Engineering 429
Handbook for Architects and Builders..... 429
Wireless Telegraphy and Telephony..... 429
Vorlesungen über Ingenieur-Wissenschaften..... 430
The Principles and Practice of Surveying..... 431
Sewage Purification for Belfast..... 431
Liquid and Gaseous Fuels. Reviewed by William Kent 432
PUBLICATIONS RECEIVED 432

REVIEWS.

A Sheaf of Road Literature.

Reviewed by S. WHINERY,* M. Am. Soc. C. E.

THE KING'S HIGHWAY.—The Nature, Purpose and Development of Roads and Road Systems. By Reginald Ryves, Assoc. M. Inst. C. E., Officer in Charge of the Technical Section of the Chief Engineer's Office, Public Works Department, Madras Presidency. London, England: The St. Bride's Press, Ltd. Cloth; 6½ × 11¼ ins.; pp. 96; 34 illustrations, partly in the text. 5s., net; American price, $2.

AUSTRALASIAN ROADS.—A Treatise, Practical and Scientific, on the Location, Design, Construction and Maintenance of Roads and Pavements. By John Montgomery Coane, Henry Edward Coane, John Montgomery Coane, Jr., Civil Engineers, Melbourne. Melbourne and Sydney, Australia: George Robertson & Co. Cloth; 5½ × 8¾ ins.; pp. 334; 136 illustrations, partly in the text.

ROAD PRESERVATION AND DUST PREVENTION.—By William Pierson Judson, M. Am. Soc. C. E., M. Inst. C. E., Author of "City Roads and Pavements." New York: The Engineering News Publishing Co. London, England: Archibald Constable & Co., Ltd. Cloth; 5⅜ × 8¾ ins.; pp. 146; text illustrations. $1.50, net.

DUST PREVENTIVES.—By Prevost Hubbard, Assistant Chemist, Office of Public Roads. Bulletin No. 34, Office of Public Roads, U. S. Department of Agriculture; Logan Waller Page, Director. Washington, D. C.: Pub. Doc. Paper; 6 × 9¼ ins.; pp. 64; three plates.

HIGHWAY ENGINEERING.—By Charles E. Morrison, Tutor in Civil Engineering, Columbia University. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9 ins.; pp. 315; 90 illustrations in the text. $2.50; English price, 10s. 6d., net.

ROAD LOCATING AND BUILDING SIMPLIFIED.—For Use in the Common Schools. By C. E. Brandt. Cumberland, Md.: The Author. Boards; 5 × 7¾ ins.; pp. 106; plates and text illustrations. $1.

In some brief remarks on road literature, the author of "The King's Highway" says:

> On the subject of roads it is remarkable what a great deal of stuff one can wade through, both in books and in current writings, without picking up a useful idea. There is a certain series of ideas on roads, partly trite and partly trivial, which reminds one of the old nursery jingle: "When you're up you're up, and when you're down you're down, and when you're half-way up you're neither up nor down."

This is one of those sayings which, when brought to our attention, strikes us as an old truth that has long laid dormant and unformulated in our minds. While there are not so very many books on road construction and maintenance, the periodicals, both technical and popular, have been loaded with road literature for many years. The unhappy reader finds variations in the jingle, but few really new notes. He wearily peruses page after page and column after column, to find the same old tweedledees and tweedledums discussed, and the same old "experiences" related in meetings, with varying expressions and results. One may find in the first edition of "Gillespie's Roads and Railroads" about as much real pabulum as in its more pretentious successors. In fact, but little really new and valuable has appeared since the days of Macadam and Telford, and even these noted English road engineers of a century ago were, perhaps without knowing it, but following in the footsteps of Trésaguet, of France.

The reader of "The King's Highway" will find it a refreshing departure from the beaten path. Figuratively, the author occasionally leaves the dusty road and explores the roadside for ideas of interest. Most road engineers will find in the book something original and worth while. Of course, the old familiar basic principles appear, but they are often shown in new lights and relations.

The author begins with a brief but intelligent discussion of the development of country roads as a system of transportation and of the relation of such a system to other methods of transportation. This is followed by a short but comprehensive outline of "Foreign Road Systems" (foreign here meaning outside of England, the author being an Englishman). Naturally, the book is largely devoted to English roads, and there is a succinct discussion of the report of the Departmental Committee of 1903 on "Highway Authorities and Administration in England and Wales" that will be welcomed by the busy American engineer. Another welcome feature of the book is its recognition and intelligent treatment of the important new element of mechanical power travel on the roads and the novel questions this introduces into road construction, maintenance and travel regulation. Thus, in a chapter entitled "Widths and Safety," will be found an interesting discussion of, and some novel and valuable suggestions relating to, road intersections and crossings with reference to the safety of high-speed motor travel, a matter which deserves the careful attention of American road engineers at present.

A chapter on "Road Lamps and Carriage Lamps" will also be found well worth reading, even if the reader does not agree with some of the author's statements and conclusions. Other chapters that may be read with profit, since they depart somewhat from the hackneyed methods of treatment, are entitled "Climate and Geology," "The Roadside" (particularly that part of the chapter devoted to roadside trees), and "Frost." A chapter on "Wind and Snow" considers the effect of sheltering woodland, hedges, etc., and methods of preventing snowdrifts on roads—a matter that has received little attention in America, except from our railroad engineers.

Altogether, "The King's Highway" is a book that can be recommended to American road engineers as well worth buying and reading.

The title, "Australasian Roads," suggests that we might expect to find in the book a pretty full and useful description of road building methods peculiar to that far-away region. If the reader takes it up with that idea he will be disappointed. The object of the authors was rather to prepare a compendium of road engineering in other countries for the use and guidance of the Australasians themselves. The book follows the well-beaten track of the average book on road construction and maintenance. American road engineers, while taking pride in the fact that the authors have drawn their data largely from American sources, will not find in the book very much with which they are not already familiar, or that will be helpful to them. From this general statement is to be excepted considerable data relating to methods and costs of road-building in Australia, New Zealand and other Australasian countries. But even this information is not always presented in such detail, and with such full statement of conditions, as to make it very valuable.

A statement of the average scale of Australasian wages, per hour, paid to the different classes of road workers is interesting and worth abstracting here, the figures being converted into American money:

Laborer, scavenger, and sweeper	$0.21
Foreman laborer	.22½
Pitcher setter (Stone paver)	.26¼
Carpenter	.27
Steam roller driver	.27
Drivers (1 horse)	.20
" (2 horses)	.45
" (4 horses)	.75
" (6 horses)	1.05

From this it appears that men competent to drive four and six horse teams are highly appreciated in those countries.

The authors propose an original formula for width of tires that is worth noting:

$$w = \frac{W}{c \times \sqrt{d}}$$

In which,

w = width of tire in inches.
W = gross weight on wheel (in pounds?)
d = diameter of wheel in inches.
c = a factor the value of which is,
for earth roads.....c = 60
for metalled roads.....c = 85
for wood block or other paved roads..c = 130

This properly takes into account the wheel diameter, usually neglected in such formulas.

Aside from macadam, the materials used for pavements in Australian cities are principally wood-block and stone-block. Asphaltum, brick and concrete pavements are used to a very limited extent. But we look in vain for statistics of the area of the several kinds in use in various Australasian cities.

As is well known, Australia has several species of wood that have great endurance in street pavements. Among these are mentioned as being extensively used: Tallow wood, Blackbutt, Jarrah and Karri. All these are very hard, very durable, but very slippery in use. As to depth of block, the

> modern tendency is to lay nothing deeper than 5 ins., it having been found that the larger blocks cost about 2s. 6d. per sq. yd. more (than 6 ins. depth) without corresponding advantages, 3-in. blocks are being successfully used abroad on less important streets, but it is to be doubted whether anything less than 4 ins. is advisable in any situation.

One wonders what the authors would think of the use of 3½-in. blocks of much less resistant wood on the heaviest traveled streets of New York.

These Australian pavements, laid on a 6-in. concrete foundation, are said to prove very durable. "Wood pavements on Queen St., one of the heaviest thoroughfares in Sydney, are said to have worn as little as 1/16-in. in eight years." The blocks are untreated, except that they are well seasoned and sometimes coated with coal-tar. "The cost of new pavement, with 5-in. blocks laid complete on 6 ins. of concrete, runs from 15s. to 18s. per sq. yd., depending on the size of the job."

It is interesting to note that during the period 1880-1890 steel-plate wheelways were used on several of the main roads approaching Melbourne, and we are told that a special type of rolled-steel channel wheelway has been used on some hundreds of miles of road in Germany, at a cost of from $5,500 to $6,000 per mile.

The road problem that is just now attracting most attention in this country is the suppression of dust. It is generally, though not with strict accuracy, called dust prevention. Measures and methods for accomplishing this being in the experimental stage in America, Mr. Judson's "Road Preservation and Dust Prevention," and the bulletin of the U. S. Office of Public Roads, entitled "Dust Preventives," appear at an appropriate time and should serve a valuable purpose.

The methods and materials tried on our roads to mitigate the dust nuisance have covered a wide range, and the results extend over the whole gamut from total failure to notable success. Mr. Judson has rendered the road engineers and road-makers of the whole country a very valuable service in collecting, collating and discussing the great mass of data on the subject, scattered through the periodicals and society transactions. The work has been very well done, and his little book should be of immediate, though not of great permanent value.

The circular (No. 34) of the Office of Public Roads, is rather a review and summation of principles than a record of experimental work. A perusal of both these little works will put the reader in possession of practically all that

*Consulting Engineer, 95 Liberty St., New York City.

is known on the subject to-day, and will equip the engineer who has not had much actual experience in this line for intelligent and effective work. What is of most importance just now, municipal officers and road supervisors may, by a few hours' reading of these books (they are not technical or beyond the easy comprehension of any intelligent man), avoid the serious mistakes in road oiling that have cost the country a large sum of money in the aggregate.

Road-oiling has heretofore been understood by large numbers of people—among whom are not a few engineers—to mean the application of any oil or tar, the cheaper the better, to the surface of dusty roads, regardless of their condition at the time. These books make it clear that only mineral oils, having a decided asphaltic base, or tars of proper quality and consistency, applied with care to the road surface after its proper preparation, can be expected to give satisfactory or reasonably permanent results. Other materials and methods, may, it is true, give temporary relief from dust, and to that extent may be useful, though of doubtful economy.

Both authors are, in the opinion of the reviewer, open to the criticism that they do not lay sufficient stress upon *dust prevention* in its true meaning; that is, the original construction of roads in such a way that the generation of dust by travel will be largely prevented. This is the ideal to be worked for, held up before the public, and reduced to practice at the earliest possible time. It may be argued that such original construction is expensive and that the public will not "stand for" the additional cost involved. But to this it may be answered, and demonstrated to intelligent people, that the alleged greater cost is apparent, not real. If it costs even as little as 6 cts. per sq. yd. per year to suppress dust on the ordinary road, that expenditure, capitalized at 4%, equals $1.50, and if for an additional cost of $1.00 per sq. yd. a new road can be made that will be practically dustless, it is obvious that such a road would be actually the more economical in the end. This view is said to be rapidly gaining ground in England, where the dust problem has been experimentally studied longest and most carefully.

Mr. Morrison states in the Preface to his "Highway Engineering" that it was prepared as a text-book for the second year students of the department of civil engineering at Columbia University, and he cautions the reader not to consider it a reference book, but rather one in which it has been the endeavor to outline and emphasize those basic principles which are essential to good highways.

The preparation of text-books for schools ought to be regarded as a very serious business. They plant seed in a virgin soil, and that seed ought to be very carefully selected and free from tares. What the pupil learns from his text-books is likely to be tenaciously held in the memory, and difficult to uproot. Their authors should, therefore, be particularly careful that the matter shall be carefully selected, the statements of facts and of principles adequate and accurate, and, in technical and industrial matters, the latest and best accepted theory and practice should be presented.

In the main Mr. Morrison's book complies with these requirements, but in some parts of it there are evidences of rather hasty work and of insufficient care in consulting and using the best authorities on his subject.

The general arrangement of the book is satisfactory. The volume contains, with some exceptions, noted later, about all that one could expect to find in a text-book for ordinary classes in civil engineering. The subject is well presented, and from the literary point of view is generally well done.

The first chapter, on Road Resistances, is quite full and satisfactory. The chapters on earth roads, gravel roads, and broken stone roads, are excellent. The description of modern methods of testing road-materials is unusually full, as it deserves to be. The New Jersey state specifications for gravel and broken-stone roads are quoted in full.

A chapter is devoted to miscellaneous roads, among which the author classes oiled roads, to which only about four pages of text is devoted. Considering the present importance of this matter the treatment is inadequate.

The subject of street design, including the laying out of cities, is quite fully dealt with, but on some details relating to the streets themselves the text is rather confusing and unsatisfactory.

Chapters VII. to X. are devoted, respectively, to stone pavements, brick pavements, asphalt pavements and modern wood pavements. It is these chapters that are most open to adverse criticism. They give the impression that the author is not very familiar with his subject, either from the lack of actual experience, or a failure to sufficiently inform himself from the best printed authorities. The definitions and descriptions are often not clear or accurate, and are sometimes actually misleading or erroneous. These might not be confusing to the ordinary, well informed reader, but a text-book should be free from them. Thus it is said: "A paving brick differs from an ordinary building brick both in shape and physical characteristics." Of course, the author meant *dimensions* or *size* instead of *shape*. "A good (paving) brick should absorb no more than 2% of moisture" is true of those made from shale, but not true of excellent paving brick made from clay. It is not true, as stated, upon a single authority and illustrated by cuts, that next to a steel wheelway brick pavement offers less resistance to traction than any other pavement. In fact the contrary is correctly stated in Chapter I.

The chapter on Asphalt Pavements shows distinctly the unfamiliarity of the author with this branch of his subject. The treatment is unsatisfactory and there are a number of inaccurate statements. The same may be said of the chapter on modern wooden pavements. In America at the present time the term modern wood pavement applies only to pavements where the wood is subjected to preservative treatment, but only half a page is devoted to the methods of such treatment.

Quotations are freely made use of in the book, but as a rule there are no references to the sources of these quotations.

Copies of specifications for the several kinds of pavements are quoted at length, but in not a few cases the sources of these specifications is not given. While detailed specifications are of value to the practicing engineer, the propriety of their extensive use in a text-book intended to teach basic principles and facts may be questioned. In this book of a little over 300 pages in all, nearly 100 are occupied by quotations of specifications in extenso, and general requirements relating to matters other than the pavements proper are repeated in a number of cases.

On the other hand, some quite important matters are omitted altogether. For instance, one looks in vain for anything relating to bituminous concrete pavements and roads, of which a large mileage is now in use in this country, and which promises to become of great importance in the road problems of the future.

On the whole it cannot be said that Mr. Morrison's book is an ideal text-book upon Highway Engineering.

Mr. Brandt's book, "Road Locating and Building Simplified," was also intended to be used as a text-book in the common schools. His evident sincerity and enthusiasm for the good-road cause must command, though the book itself does not merit, respect. Engineers will read it with no little amusement. The leading propositions advanced by the author appear to be that the art and science of road location and construction ought to be simplified and taught, along with the three R's, in the public schools; and that highways should be laid out with the same care and upon the same system of gradients as are the railroads. He holds that the employment of high-grade engineers and expensive instruments are not necessary for the proper location and construction of roads.

Two New German Text-Books and a Third Edition.

AUSBAU VON WASSERKRAFTEN.—By [illegible] Koehn. (Book XIII. of "Der Wasserbau," Part [illegible] Handbuch der Ingenieurwissen-schaften"). [illegible] Leipzig, Germany. Wilhelm Engelmann. [illegible] 11 ins.; pp. 545 to 1232; 40 plates and [illegible] illustrations. 30 marks; American price, $[illegible]

LEHRBUCH DES HOCHBAUES.—Edited by [illegible] Esselborn. Vol. 1.: Grundbau, Steinkonstruk[illegible] Holzkonstruktionen, Eisenkonstruktionen [illegible] Betonkonstruktionen. By Karl Esselborn, [illegible] Koss-mann, Karl Stief, Georg Rüth and Reis[illegible] Weder. Leipzig, Germany. Wilhelm Engelmann. [illegible] Paper, 7½ × 11 ins.; pp. 499; numerous illustrations in the text. 15 marks; American price, $6.

LEHRBUCH DES TIEFBAUES.—Edited by [illegible] Esselborn. Third Edition, enlarged. Vol. [illegible] Erd-, Strassen-, Eisenbahn- und Tunnelbau, St[illegible] Futter-, Kai- und Staumauern. By Hans Wege[illegible] and Leo v. Willmann. Leipzig, Germany: Wilhelm Engelmann. Paper; 7½ × 11 ins.; pp. 493; numerous illustrations in the text. 15 marks; American price, $6.

The first volume of Koehn's "Ausbau von Wasserkräften" [Development of Waterpowers] was noticed some time ago. The second and concluding volume now presents itself, a bulky 600-page production. The first volume contained general matter on water-powers, estimation, statistics, etc., and a series of descriptions of 26 European and one American hydraulic electricity works. The present volume completes the descriptive album with three American and five European plants, and gives a tabular summary of some 50 other modern plants. It then discusses "Details" in 600 pages. Every element of a waterpower plant is fully treated here with reference to both design and operation. The author has collected his material from all the world's literature, and has analyzed it in understanding manner. This remark applies to the hydraulic portions. There are 150 pages on the electric equipment (power-station machinery—the transmission line), but the subject is far too large to be treated at all fully in such compass, and to fit into the plan of the hydraulic part of the book it should have been left for a separate work. The volume is therefore to be characterized as a treatise on the construction of works for developing hydraulic power.

Incidentally, the work of which this book forms the second part is called Vol. 13 of a series of works on "Wasserbau" (ranging from hydrology and water-supply to canal, river and harbor work, sewerage, and power development); and in turn these works on Wasserbau are Section III (of five sections) of a group of books from the same publisher called "Handbuch der Ingenieurwissenschaften" or Manual of Engineering.

"Lehrbuch des Hochbaues" deals with building construction, exclusively from the German standpoint, with but few exceptions. Its main subdivisions are Foundations, Masonry (including arches, vaults, domes and stairs), Timber framing, Steel framing, and Reinforced concrete. The sections on masonry and timber may be read with profit by American engineers. The book is not complete in this volume, but will have a second part, dealing with architecture and the management of building construction.

Wegele & v. Willmann's "Tiefbau" appeared only four years ago, but already two editions have been sold out. Since the first publication, two new chapters have been added, "Tunnels" and "Retaining Walls and Dams," and numerous minor revisions and additions have been made. The work has also been split into two volumes, the first of which is before us. This covers Earthwork, Street and Road Construction, Railway Location and Construction, Tunnels, Retaining Walls and Dams. Much of the text is apt to

TRAUTWINE'S
CIVIL ENGINEERS'
POCKET BOOK

18th Edition, 90th Thousand, 1907, $5.00

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prove valuable in this country for comparison of our methods with the German, especially the chapters on Roads and Railways.

Telephone Construction Costs.

TELEPHONE CONSTRUCTION.—Methods and Cost. By Clarence Mayer, Formerly Cost Statistician and Fa-cilities Engineer, Chicago Telephone Co. Appendix A: Cost of Materials and Labor in Constructing a Telephone Line. By J. C. Slippy, Consulting Tele-phone Engineer. Appendix B: Miscellaneous Cost Data on Pole Line and Underground Conduit Con-struction. (Compiled by the Editors of Engineering Contracting). Chicago and New York: The Myron C. Clark Publishing Co. Cloth; 6 × 9¼ ins.; pp. 293; 103 illustrations in the text and 157 tables. $5 net.

The volume naturally divides into two nearly equal parts, in the first of which typical meth-ods recognized as good practice, are described and pictured, and forms are given as successful schemes for collecting and keeping the labor costs of all such construction. In addition, actual records of labor costs, which it is stated represent work done under various conditions in city and country, are given. This first part gives no costs of material, as the author of this section seems to have considered such supplies as stand-ard commodities whose prices and quantities are best obtained locally. These construction meth-ods are considered in five chapter groupings: (1) Cost of pole-line work; (2) cost of cable con-struction; (3) cable splicing; (4) removing old lines and reconstructing; (5) underground con-duits.

The second half of the book consists of two chapters by Mr. Mayer and the two appendices. Mr. Mayer's first chapter and the appendices contain tabulated data covering the total cost, including material, of a great variety of tele-phone work. Mr. Mayer's other chapter describes some practices leading to systematic and ac-curate estimating. Approved forms are given as estimate blanks for city, toll, farm, cable and conduit line construction, removal of material, and office records.

The book recommends itself as being a vol-ume of exact records of experience and not of theories and opinions.

KRAFT.—By E. Reyer. Leipzig, Germany: Wilhelm Engelmann. Paper; 6 × 9¼ ins.; pp. 380; 257 illus-trations in the text.

The title of this work: "Power; Economic, Technical and Historical studies of National Strength" is best explained by a mention of the principal chapter heads: The Era of Steel; Re-lation of Coal to Civilization; Precious Metals; Industrial Rivalry of Nations; The Industry of the United States; Factory and Individual Manu-facture; Control of the Sea; Internal Naviga-tion; Land Transportation; Agriculture; Food Cost; Power Development in the United States; Explosives, etc. The treatment is statistical. Thought as well as style are remarkably jerky.

ELECTRICAL CONTRACTING.—Shop System, Estimat-ing, Wiring Construction Methods, and Hints on Get-ting Business. By Louis J. Auerbacher. New York: McGraw Publishing Company. Cloth; 5¼ × 8¾ ins.; pp. 155; 225 illustrations in the text. $2, net.

This book may be expected to appeal to wire-men and contractors. It is full of suggestions for the practical man, especially about "extras" which he may sell his customer and which should yield him an attractive profit.

Chapter I. gives the outline of a working sys-tem for an electrical contractor employing some 12 or more men. Certain definite forms are rec-ommended as proper records for orders entered, work done, goods supplied and returned, as time sheets, cost books, progress reports, etc. Chapter II. outlines a way of studying specifications and plans for preparing estimates and proposals. The rest of the book is a collection of sugges-tions for the contractor or for his workmen on such topics as the selection of a two or three-wire system, running mains and feeders, details of open, molding and conduit wiring, installing direct-current motors and switchboards, running signal, alarm and telephone circuits, etc.

In one chapter a sample specification is given for wiring a residence already built. This specifi-cation, with its accompanying analysis, shows the proper installation of all sorts of electrical conveniences.

HOW TO BUILD UP FURNACE EFFICIENCY.—By Jos. W. Hays, Combustion Engineer, Author of "Combus-tion and Smokeless Furnaces," etc. Chicago, Ill.: The Author (601 Hartford Building). Paper; 3½ × 6¼ ins.; pp. 47. 50 cts., postpaid.

In somewhat picturesque style the author of this little brochure tells how an operating engi-neer may trace out the preventible causes of fuel waste in a boiler plant. The apparatus whose general use is explained in a hand-analysis set for easily determining CO_2, CO and O. By study-ing the action of fuel-bed thickness, draft, damp-ers, etc., on the CO_2 and O in the product of com-bustion at various parts of the boiler and flue the way to the best attainable furnace efficiency is found for each particular situation.

STRUCTURAL ENGINEERING.—By A. W. Brightmore, D. Sc., M. Inst. C. E. New York, London and Paris: Cassell & Co., Ltd. Cloth; 5½ × 9 ins.; pp. 280; 145 figures in the text. $3.75, net.

The author's effort to produce a students' text, "intermediate between what is generally called Strength of Materials and such specialized works as, for instance, Claxton Fidler's 'Bridge Con-struction,' or Merriman & Jacoby's 'Roofs and Bridges,'" has resulted in a concentration of much material within the small compass of 275 pages, but has also put this material into such shape that it is rather hard reading. It may be commended as being sound, though for the most part distinctly English, both in terminology and in methods of treatment. On the other hand, the explanations are often seriously obscured by the constraint of brevity; the author does not take time to establish basal ideas and introduce the reader to familiarity with the general line of thought taken by the analysis. This is a grave defect if the book is considered for self-study, though in school use the instructor can of course help over the difficulties.

The author has, it seems, attempted to cover too much ground for best results. The analysis of simple trusses and plate girders under both dead and live loads might well occupy the entire book, but in addition the author has added the complex subjects of arches and suspension bridges. Not content even with this, he dis-cusses also retaining walls, foundations, dams, and finally reinforced concrete. It is true that in most of these chapters, except perhaps sus-pension bridges, he succeeds in giving the funda-mentals and also the working methods, suf-ficiently for the beginnings of practical use. But even this knowledge must be extracted by the reader with needless effort. A clearer didac-tic style and sufficient dilution to make the book palatable would have commended the book to the reader's attention far more forcibly.

HANDBOOK FOR ARCHITECTS AND BUILDERS.—By Emery Stanford Hall (Editor). Chicago: The Chi-cago Architects' Business Association (153 La Salle St.). Leather; 6¼ × 9¼ ins.; pp. 352; illustrated.

This annual publication has been materially enlarged and extended for its eleventh edition. It opens with a statement of the purposes of the association and its schedule of charges for pro-fessional service; also the Illinois law requiring the licensing of architects and a list of architects thus licensed. The Chicago building ordinances (with all amendments up to June, 1908) are given in full, together with the ordinances of the boiler inspection, smoke inspection and elec-trical inspection departments. Specifications are given for concrete sidewalks, vault coverings, hollow tile fireproofing, and gravel roofing. Sev-eral pages are devoted to tables and notes of general information useful to architects and builders, and there is a complete subject index for filing drawings and information according to the Dewey classification. Some of the special contributions are as follows: The calculation of base plates for columns, Prof. N. Clifford Ricker; Formulas for heating and ventilating, Homer R. Linn; Strength of reinforced columns and beams, Prof. Arthur N. Talbot; Elevating and conveying machinery, S. F. Joor; Varnish, Herman Rosenberg; Voids, settlement and weight of crushed stone, Prof. Ira O. Baker; the architectural orders and their application, A. W. S. Cross and A. E. Munby. Numerous adver-tisements are scattered throughout the book.

WIRELESS TELEGRAPHY AND TELEPHONY.—Pop-ularly Explained. By Walter W. Massie and Charles R. Underhill. With Special Article by Nikola Tesla. New York: D. Van Nostrand Co. Cloth; 4¾ × 7½ ins.; pp. 76; 29 illustrations, mostly in the text. $1, net.

The authors of this little work have succeeded better than one might expect in the task of giving the lay reader simple ideas of wireless telegraphy and telephony. Electric oscillations are illustrated by familiar analogies of vibra-tions and waves in liquids. The construction and operation of the various pieces of apparatus employed are given brief description, and then the authors pass on to discuss the present uses and possibilities of wireless telegraphy. The proposed government regulation of wireless

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Mehrten's Iron Bridge Building: A Historical Monograph.

VORLESUNGEN UEBER INGENIEUR-WISSENSCHAFTEN.—By Georg Christoph Mehrtens, Professor of Engineering at the Royal Technical College in Dresden. Part II., Eisenbrückenbau: Vol. I., Gesamtanordnung der Festen Eisenbrücken und Ihre Geschichtliche Entwickelung bis auf die Gegenwart. Leipzig, Germany: Wilhelm Engelmann. Stiff paper; 7¼ x 10¼ ins.; pp. 814; 970 illustrations in the text. 40 marks; American price, $16.

Something in the way of appreciation is owing to Professor Mehrtens from every bridge engineer, and from countless future devotees of the science, for the patient, careful labor which has resulted in the notable volume before us. Technical books do not as a rule recompense their authors with any splendid income from royalties, but on the contrary often pay less than day-laborer's wages for the time spent in writing; the author must seek his reward, therefore, in the consciousness of work well done and in the gratitude of his readers. And in the present case the result merits such gratitude. We have not had a comprehensive history of bridge-building, and we are not likely in the future to have one much better or more thorough than that of Mehrtens.

We speak of the book as a historical monograph in spite of the fact that it contains other matter also; over 100 pages on loads, rivets and bolts, general disposition of parts of bridges, etc., besides a chapter on iron production which is partly historical. But this matter is at best of very ordinary quality, and for the most part has no real justification for being in this work, entirely aside from the fact that it is placed most unfortunately, splitting the history of bridges into two parts which should be contiguous. To some extent, perhaps, its inclusion and its placing are chargeable to the fact that the book is a reproduction (with slight revision) of a series of college lectures. This also accounts for some minor features of the arrangement and phrasing of the text of the rest of the book, which, however, do not markedly decrease its merits. The same fact is responsible for making this book, though worthy of standing alone, a component member of a series of six volumes, three of which ("Statik der Baukonstruktionen und Festigkeitslehre") were published some years ago, while the remaining two (on "Modern Bridge Details" and "Special Types of Bridges and the Construction of Bridges") will be issued in two or three years. Fortunately the nature of this volume, entirely historical and descriptive, makes it virtually independent of the others.

An important exception to this last statement must be noted: namely that movable bridges, which doubtless also have a history, are not mentioned. A distinction is made only in favor of ferry-bridges, structures that class under the head Movable bridges with better right than under Fixed bridges. Most of the seven or eight ferry-bridges in existence are shown and described in this volume. Other movable bridges, presumably, will be discussed in a subsequent volume.

The modern steel bridge descends from several very different prototypes: the wooden beam, the stone lintel and arch, the corbeled cantilever structures found variously among primitive races, the primitive hanger-stayed beam structures and pure suspension bridges, etc. Perhaps the list should include, as one of the most important, the timber rafter roofs, which at some period prior to the Roman imperial age were transformed into simple trusses by the addition of a tiebeam, and were later improved by queen-post and other internal bracing arrangements. It might appear, indeed, that these early trusses, which went through a regular (if obscure) development prior to the nineteenth century, should be regarded as the sole progenitors of the modern bridge, since, abstractly viewed, the whole advance (excepting now the introduction of iron into the art) has been the perfecting of articulated frames. But historically the advance was of a different kind.

The development of the several primitive types converged. While the typical element in each case retained its individuality, hybrid intermixtures in large number appear. Further, the progress of man's ability to span a wide gap by a substantial carrying structure, if we measure this progress by the growth of the gap which he could span, skips irregularly from one form to another (and this in spite of the immense favor of the stone arch), from suspension bridge to arch and back again, from arch to truss or to such remarkable mixed forms as the bridges built by the Swiss brothers Grubenmann (one of these is illustrated in Johnson, Bryan & Turneaure's "Modern Framed Structures"). The primitive types, of course, are entirely distinct even today, as appears clearly from their distinctive names and their separation from each other in treatises on bridges. But the definite conceptions of today as to stresses and structural value grew slowly and uncertainly by convergence and alloying out of the separate conceptions of the action of the separate types. In fact, the evolution of the truss idea from the suspension bridge with balancing strut, on the one hand, and from the arch with tie-rod, on the other, is especially evident in the bridge history of the last 150 years.

Professor Mehrtens' review of the origin and the preparatory period of bridge-building, the time prior to the nineteenth century, is somewhat disappointing because the paths of development are not more clearly traced out and their interweaving shown. Even time sequence is not followed consistently by the author, but bridges of most various ages are grouped often with no better connection than a minor text allusion. This is evidently a criticism that cannot readily be justified in default of showing by example how the task might be performed better. Two individual omissions offer more certain ground for criticism: first, the neglect of the doubtless numerous pile trestle bridges of antiquity, and second, the total omission of any reference to the extensive and often admirable roof framing of former times, particularly of the medieval era. As to the first, the author does not separate pile bridges from those with stone piers, and of both classes mentions only a bridge of Nebuchadnezzar over the Euphrates (timber on stone piers, 6th century, B. C.), the Pons Sublicius over the Tiber, made famous by Horatius, about the same period, one of Alexander over the Euphrates of some 200 years later, Caesar's bridges and several later Roman bridges, including one that seems to be a compound timber-block arch (Trajan's bridge over the Danube, 103-105 A. D.). Pontoon bridges such as those of Darius and Xerxes are also noted, of course. As to roof frames, the author says nothing further than that kingpost trusses were common among the Romans, and that the old Egyptians had also used trusses for roofs. The intimate relationship of roof trusses and bridge trusses needs no remark, of course.

But after all the observer of bridge progress is forced to recognize that, stone arches excepted, nothing of enduring importance was achieved until the age of iron. The Revolutionary War coincided roughly with the beginning of the new period; in 1779 the 100-ft. cast-iron arch bridge over the Severn at Coalbrookdale, in England, was finally successful, a structure which, though not leading directly toward progressive development, yet marks the introduction of new ideas and a new material. Faustus Verantius, a Venetian engineer, had suggested cast-metal (bell-metal) arches nearly two centuries earlier, but his ideas do not appear to have been realized, nor did the plans of various French engineers of the 18th century for building cast-iron bridges succeed any better. A 40-ft. flat arch bridge of open-work ribs like those of the English bridge was built in Germany in 1796, according to Mehrtens. It is interesting to note that both these bridges are still standing and in service. In this connection, a very striking design pictured by the author is Telford's plan of 1801 for a cast-iron arch bridge over the Thames of 600-ft. span, to replace the old London Bridge. Needless to say, this was never built, but the project has not been paralleled until the recent proposal for a 700-ton concrete arch in New York City, and this is planned with a rise three or four times as great as the rise of Telford's arch.

From this point onward, Mehrtens' review of bridge development is all that could be desired, in completeness, variety, arrangement and intelligent comment. The material is classified by main types, in six chapters: Beginnings of suspension bridge building; Cast-iron arch bridges; Chain bridges of the 19th century; Wire-cable bridges; Girder and Arch bridges up to the introduction of ingot metal; and, to conclude, 100 pages on Bridges of today.

It is a particularly remarkable fact in bridge history, that the development in the modern period, since 1800, was accomplished in America and England. The latter country furnished the more famous engineers, and the plate-girder tube bridges of Stephenson, the suspension bridge of Telford and the remarkable tube-chord structures of Brunel still receive well-merited admiration. But outside the field of suspension bridges, only the Warren truss (which, according to Mehrtens, was invented by Néville in France, 1845, but was improved by Captain Warren) remains as an English contribution in the present-day art. For the rest, the origins and the development lie in America. Burr, Wernway, Long and Howe established a permanent basis for advance by their truss designs, although they were working altogether in wood. Later Whipple, Linville, Murphy and their successors were no less fundamental for iron truss construction. Suspension bridge building also received its first impulse in the United States, although Telford and other English engineers contributed notable achievements.

In the 550 pages which these six chapters occupy the author presents a wealth of illustrations, whose number and excellence is fully commensurate with the importance and many-sidedness of the subject. Movable bridges, already spoken of, and plate-girders (except the tubular bridges) are the only structures not covered by this text. For all other forms of iron bridge the author has built a historical review which will occupy permanently a long vacant niche in the literature of the engineering profession, and indeed, in the literature of the history of civilization.

NOTES ON THE DRAINAGE OF LARGE AREAS.—By A. M. Shaw, Assoc. M. Am. Soc. C. E., Consulting Engineer. Dixon, Ill.: The Author. Paper; 6 x 9 ins.; pp. 14; two illustrations in the text. 25 cts.

The author states that his discussion has been prepared chiefly for drainage commissioners and engineers, and that it is confined "to ordinary gravity drainage systems such as are found in the States of the Middle West."

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THE PRINCIPLES AND PRACTICE OF SURVEYING.—Vol. II. Higher Surveying. By Charles B. Breed, Assistant Professor of Civil Engineering, and George L. Hosmer, Assistant Professor of Civil Engineering, Massachusetts Institute of Technology. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5⅛ × 9¼ ins.; pp. 432; 162 illustrations, mostly in the text, and 17 tables. $2.50; English price, 10s. 6d., net.

The first volume of this work, reviewed in our issue of Nov. 15, 1906, was admittedly an "elementary treatise . . . to give to the student a thorough training in the fundamental principles . . . of surveying, computing and plotting." The second volume, just issued, continues the treatment into the higher branches of topographic and hydrographic surveying, but still adheres to the original purpose of being mainly a manual of practice, a "description of the methods of conducting surveys." In the latter book the scheme of approaching the advanced studies is a logical form of development although it is somewhat novel in that it subordinates the usually emphasized precise measurement methods to the broader fields of topographic and hydrographic surveying.

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With the vast number of surveying treatises on the market there is only one feature in a new book on the subject which can make it compete with the standard works. The subject matter itself has been so well thrashed over that there can be little added to it, so the more orderly arrangement and careful selection of that matter is the only field of endeavor for those college professors in whom the calls of authorship are ever insistent. In orderly arrangement Messrs. Breed and Hosmer have been most successful, but the two rather bulky volumes indicate that more care could have been bestowed on the selection.

SEWAGE PURIFICATION FOR BELFAST.—Final Report on the Scheme, and Its Probable Effects on the Lough. By E. A. Letts, D. Sc., Ph.D., etc., Professor of Chemistry and Joint Lecturer on Sanitary Science in the Queen's College, Belfast. Paper; 6 × 9¾ ins.; pp. 104; ten plates; folding and other tables.

This report details some of the observations and experiments that have been made with a view of determining the best method of preventing enormous growths of a seaweed called *Ulva latissima*, in salt waters adjacent to Belfast, Ireland. The growth is one that seems to be due to sewage pollution, and that depends upon an abundance of ammonia and nitrates. After making experi-

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ments with various methods and combinations of methods of sewage treatment, it was concluded that as ordinarily employed all were unsatisfactory because of the resulting nitrates. To obviate these, denitrification beds were proposed. A brief abstract of portions of the report will be published in a later issue of Engineering News.

Liquid and Gaseous Fuels.

Reviewed by WILLIAM KENT,* M. Am. Soc. M. E.

LIQUID AND GASEOUS FUELS.—And the Part They Play in Modern Power Production. By Vivian B. Lewes, F. I. C., F. C. S., Professor of Chemistry at the Royal Naval College, Greenwich, etc. New York: D. Van Nostrand Co. Cloth; 5½ x 8½ ins.; pp. 334; 54 illustrations in the text. $2, net.

As stated in the preface, this book attempts to treat the subject of liquid and gaseous fuels from a popular but comprehensive point of view, and it is not intended to take the place of the standard treatises on the several branches of the subject. The first three chapters treat of the chemistry of fuel and combustion, solid fuels, calorimetry, etc., and contain what is usually found in books treating of these subjects. Chapters IV. and V., covering 55 pages, contain a very satisfactory discussion of liquid fuel and the methods of burning it so as to obtain the most economical results. The next two chapters devote 78 pages to the manufacture of coal gas and its use for heating and power. Water gas is next treated of to the extent of 35 pages, and this chapter contains an interesting historical statement of the development of the modern processes, and illustrations of different forms of apparatus are given.

Chapter IX. is entitled "Poor Fuel Gas," and relates to producer gas and its modifications. Credit for the first gas producer of what is commonly called the Siemens type, is given to Bishop, 1839, who seems to have anticipated Frederick Siemens by 17 years. The Mond process and several styles of suction gas producers are illustrated. The last chapter treats of the "Fuel of the Future;" that is, the fuel that the world will have to use when all its available stores of coal, peat, wood and oil are exhausted. That fuel is alcohol, which can be made from annual crops of potatoes, beet roots, and other things from which alcohol can be made. As long as the sun shall continue to give light and heat to the earth, causing vegetable matter to re-convert all the carbon dioxide produced by the burning of carbonaceous fuels back into carbon, so long will the fuel supply of the world last. The chapter closes with a discussion of the subject of the use of alcohol instead of petroleum derivatives in the internal combustion engine, and gives the conclusions reached by Dr. Lucke, of Columbia College, after his tests of alcohol in a gasoline engine.

The author is a master of his subject, writes in a clear and often interesting style, and he has made a useful book which is worthy of a place in any engineer's library.

Publications Received.

ALLOYS (Non-Ferrous).—By A. Humboldt Sexton, F. I. C., F. C. S., Professor of Metallurgy in the Glasgow and West of Scotland Technical College. Manchester, England: The Scientific Publishing Co. Cloth; 5½ x 8¾ ins.; pp. 283; 137 illustrations in the text. 7s. 6d., net; American price, $3.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—Proceedings of the Annual Meeting Held at Montreal, June 24-26, 1908. (P. W. Drew, Secretary, C/o W. C. Ry., Chicago, Ill.) Paper; 5¾ x 8½ ins.; pp. 158.

A BRIEF COURSE IN ELEMENTARY DYNAMICS FOR STUDENTS OF ENGINEERING.—By Ervin S. Ferry, Professor of Physics in Purdue University. New York: The Macmillan Co. Cloth; 5½ x 8¾ ins.; pp. 182; 121 illustrations in the text. $1.25, net.

CIVIL SERVICE COMMISSION (Massachusetts).—Annual Report, from Oct. 1, 1906, to Sept. 30, 1907, inclusive. (Warren P. Dudley, Secretary, Rooms 151-152, State House, Boston). Boston, Mass.: Pub. Doc. (No. 53). Paper; 5¾ x 9 ins.; pp. 223; two plates.

CONCRETE SYSTEM.—By Frank B. Gilbreth, M. Am. Soc. M. E. New York: The Engineering News Publishing Co. Flexible morocco; 11 x 8 ins.; pp. 182; 11 plates and 220 text illustrations. $5, net.

DEPARTMENT OF PUBLIC WORKS (New South Wales).—Report for the Year Ended June 30, 1907. (Charles Alfred Lee, Secretary for Public Works.) Sydney, N. S. W.: Pub. Doc. Paper; 8¼ x 13 ins.; pp. 122; 20 plates and 2 folding maps. 4s.; American price, $1.60.

*Consulting Engineer, 601 Comstock Ave., Syracuse, N. Y.

DIFFERENTIAL AND INTEGRAL CALCULUS.—By Daniel A. Murray, Ph.D., Professor of Applied Mathematics in McGill University. London, Bombay and New York: Longmans, Green & Co. Cloth; 5¼ x 8¼ ins.; pp. 491; numerous figures in the text. $2, net.

THE ELEMENTS OF PHYSICS.—A College Text-Book. By Edward L. Nichols and William S. Franklin. In three volumes. Vol. II. Electricity and Magnetism. New edition, entirely rewritten. New York: The Macmillan Co. London, England: Macmillan & Co., Ltd. Cloth; 5½ x 8¾ ins.; pp. 303; [illegible] illustrations in the text. $1.60, net.

ELEMENTS OF RAILROAD TRACK AND CONSTRUCTION.—By Winter L. Wilson, Professor of Railroad Engineering, Lehigh University. New York: John

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GEORGIAN BAY SHIP CANAL SURVEY.—Report on the Precise Leveling, Years 1904 to 1907. Eugene D. Lafleur, Chief Engineer. Sessional Paper No. 19a, Department of Public Works of Canada, Ottawa, Canada: Pub. Doc. Paper; 6½ × 10 ins.; pp. 157; text illustrations and one folding map. 15 cts.

HEATING AND VENTILATION.—A Working Manual of Approved Practice in the Heating and Ventilating of Dwelling-Houses and Other Buildings, with Complete Practical Instruction in the Mechanical Details, Operation and Care of Modern Heating and Ventilating Plants. By Charles L. Hubbard, Consulting Engineer on Heating, Ventilating, Lighting and Power. Chicago, Ill.: American School of Correspondence. Cloth; 6½ × 9¾ ins.; pp. 221; plates, and 177 text illustrations. $1.50.

MANUAL OF REINFORCED CONCRETE AND CONCRETE-BLOCK CONSTRUCTION.—By Charles F. Scott, M. Inst. C. E., M. Am. Soc. C. E., M. Inst. M. E., and William Dunn, F. R. I. B. A. New York: D. Van Nostrand Co. Flexible leather; 4 × 6¾ ins.; pp. 290; 113 illustrations in the text, and 52 tables. $2.50 net.

THE MINERAL INDUSTRY.—Its Statistics, Technology and Trade During 1907. Founded by Richard P. Rothwell. Edited by Walter Renton Ingalls, M. Am. Inst. M. E., Editor of the "Engineering and Mining Journal." Vol. XVI., Supplementing Vols. I. to XV. New York: Hill Publishing Co. Cloth; 6 × 9½ ins.; pp. 1,127; plates and text illustrations. $10.

THE MODERN VIEW OF ELECTRICITY.—By Lucien I. Blake, Consulting Engineer Submarine Signal Co., Boston, Mass. (Proceedings of the Colorado Scientific Society, Vol. IX.) Denver, Colo.: The Society. Paper; 6¼ × 9½ ins.; pp. 47 to 64.

NATIONAL IRRIGATION CONGRESS.—Official Proceedings of the 15th Congress, Held at Sacramento, Cal., Sept. 2-7, 1907. Edited by W. A. Beard (Chairman Executive Committee, Sacramento, Cal.). Paper; 6 × 9 ins.; pp. 283; illustrated.

THE PROPER DISTRIBUTION OF EXPENSE BURDEN.—By A. Hamilton Church. New York: The Engineering Magazine. Cloth; 5 × 8 ins.; pp. 116. $1.

PUBLIC SERVICE COMMISSION, STATE OF NEW YORK (Second District).—First Annual Report, for the Six Months Ending Dec. 31, 1907. (Frank W. Stevens, Chairman.) In two volumes, with two large folding maps in separate envelope. Albany, N. Y.: Pub. Doc. Vol. I.: Cloth; 5¾ × 9¼ ins.; pp. 745. Vol. II.: Cloth; 9 × 12¼ ins.; pp. 267.

SOME THINGS A MANUFACTURER SHOULD KNOW ABOUT COAL.—By E. G. Bailey, Chief of Coal Department. Professional Papers No. 3, Contributions to Engineering Chemistry, by Members of the Staff of The Arthur D. Little Laboratory. Boston, Mass.: The Laboratory (93 Broad St.). Paper; 6 × 9 ins.; pp. 10.

STEAM POWER PLANT ENGINEERING.—By G. F. Gebhardt, Professor of Mechanical Engineering, Armour Institute of Technology, Chicago, Ill. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 816; 461 illustrations, mostly in the text. $6, net; English price, 25s. 6d., net.

STREAM FLOW DATA WITH REFERENCE TO WATER POWER IN CONNECTICUT AND VICINITY.—By Charles E. Chandler, Civil Engineer, Norwich, Conn. (Reprinted from Journal of the Connecticut Society of Civil Engineers, 1908.) Paper; 6 × 9¼ ins.; pp. 66; 17 tables.

STRUCTURAL TIMBER.—By W. K. Hatt, Civil Engineer, Forest Service, U. S. Department of Agriculture. (Paper presented before Western Railway Club, March, 1908; J. W. Taylor, Secy., 390 Old Colony Building, Chicago, Ill.) Paper; 6 × 9 ins.; pp. 28; 17 illustrations in the text.

VIRGINIA HEALTH BULLETIN.—Vol. I., No. 1, July, 1908. Richmond, Va.: State Department of Health. Paper; 6 × 9 ins.; pp. 15.

WHOLESALE PRICES, 1890-1907.—INDUSTRIAL HYGIENE.—Bulletin of the Bureau of Labor, No. 75, March, 1908. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 283 to 663.

WOOD PAVING IN THE UNITED STATES.—By C. L. Hill, Forest Assistant. Circular 141, Forest Service, U. S. Department of Agriculture, Gifford Pinchot, Forester. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 24; three figures in the text.

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CONTENTS.

CONSTRUCTION NEWS:
Plans and Specifications on File....131
List of Contracts Pending.....131
Railways 132
Electric Railways 132
Light and Power Plants.....132
Bridges 133
Buildings 133
Water Supply and Irrigation.....135
Sewerage 135
Streets and Roads.....136
Manufacturing Plants.....137
Miscellaneous Contracts 137
Contract Prices 137
U. S. Possessions and Cuba.....138
CIVIL SERVICE EXAMINATIONS.....138
INDUSTRIAL NOTES 138
PROPOSALS 138

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10-30*	Dredging,	Tuckerton, N. J...(S.)	10- 8
11-14	Coal-handling plant,	Charleston, S. C. .....(S.)	10-15
11-17*	Lock and dam,	Mobile, Ala.	(P. & S.) 9-17
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10-24* Power-plant, University, Ala.....10-15
10-26 Elec. equip., New York.....10-15

BRIDGES.

10-16 Bridge, Chappells, S. C.....10-15
10-17 Bridge, Amanda, Ohio 10- 1
10-19 Bridge, Taylorsville, Ohio.....10- 8
10-19 Bridges, Winfield, Kan.....10-15
10-22 Bridge, Newark, Ark.....10-15
10-22 Bridges, etc., Indianapolis, Ind..10- 8
10-23 Bridge repair, Venice, Ohio.....10-15
10-24 Bridge, Sabina, Ohio 10-15
10-26* Viaduct work, Lynchburg, Va.....10-15
10-26 Abutments, etc., Byesville, Ohio.10- 8
10-26 Bridge, Barstow, Cal.....10- 1
10-27 Bridge, Portsmouth, Ohio.....10- 8
11- 5* Bridge, Austin, Tex.....10-15
11- 7 Bridges, Frankfort, Ind.....10- 8
11-12 Bridge, Charles City, Iowa.....10-15

BUILDINGS.

10-16 Armory, New York 10- 8
10-16* Plaza impvts., Wash., D. C....10- 8
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10-21 Engineering bldg., Ann Arbor, Mich. 10- 1
10-22 Mech. equip., Philadelphia, Pa....10- 8
10-23 Quarters, Ft. Du Pont, Del. 10- 1
10-23 Alterations, New York.....10-15
10-25 Laundry machinery, New Orleans, La. (Mfg. Pl.).....10-15
10-26 Refrigerating plant, Leavenworth, Kan. (Mfg. Pl.) 10- 8
10-27 School, Paterson, N. J.....10-15
10-27 Y. M. C. A. bldg., Yarmouth, N. S. 10-15
10-28 School plans, Lynn, Mass.....10- 1
10-29 School, Cambridge, Ohio.....10-15
10-30* Post-office, Carthage, Mo..... 9-24
10-30 Storehouse, Honolulu, H. T. (U. S. Poss.) 10-15
10-31 Cells, Tacoma, Wash.....10-15
11- 1 Factory, Anderson, Ind. (Mfg. Pl.)10-15
11- 1 School, Wilkinburg, Pa.....9-10
11- 2* City Hall, Chicago, Ill.....10- 8
11- 2 Plans, Indianapolis, Ind.....10- 8
11- 3* Quarantine station, Brunswick, Ga. 10-15
11- 4* Post-office, Marietta, Ga.....10- 8
11- 4 Buildings, No. Chicago, Ill.....10- 1
11- 5* Interior work, Cleveland, O.....10- 1
11- 7 Post-office, Eugene, Ore.....10- 8
11- 9 Tower, St. Paul, Minn.....10- 8
11-10 Court-house, Schenectady, N. Y..10-15
11-12* Hospital, Weehawken, N. J.....10-15
11-18* Post-office, New Ulm, Minn.....10-15
10-21 Fire houses, New York, N. Y.....10-15

WATER-WORKS.

10-17 Pipe, Lincoln, Neb.....10-15
10-17 Water-works, Kirwin, Kan.....10-15
10-19 Water-works, Oakland, Md.....10- 1
10-19* Engine, Houston, Tex..... 9-17
10-19 Water conduit, Syracuse, N. Y..10- 8
10-19 Water-works, East Grand Forks, Minn. 10-15
10-19* Engine, Muskegon, Mich.....10-15
10-19 Pumping station, Dayton, Ohio...10-15
10-20 Well, Lower Brule, S. Dak.....10- 8
10-21 Meter tube, Camden, N. J.....10- 8
10-21 Water main, East Liverpool, O...10-15
10-24 Pump pit, Chicago, Ill.....10-15
10-26 Water meters, Victoria, B. C....10- 8
10-28 High pressure system, New York.10-15
10-29* Water-works, Helena, Mont.....10- 8
10-30 Water pipe, etc., Passaic, N. J.... 9-17
11- 2 Water pipe, Los Angeles, Cal.....10-15
11- 3 Tank, Mendota, Wis.....10-15
11-23* Filtration plant, Wilmington, Del.10-15

SEWERS.

10-15 Sewer, West New York, N. J.....10-15
10-16 Sewer, Pittsburg, Pa.....10-15
10-16* Sewer, Louisville, Ky.....10- 8
10-17 Sewer, Decatur, Ill.....10-15
10-17 Sewers, Cincinnati, Ohio.....10-15
10-19 Sewer, Zanesville, Ohio.....10-15
10-19 Sewer, Gallon, Ohio.....10-15
10-19 Sewer, Florence, Ala.....10-15
10-19 Sewer, Oakland, Md 10- 1
10-20 Disposal plant, Cheswick, Pa.....10-15
10-21 Sewer, Louisville, Ky 9-24
10-21* Sewer, Louisville, Ky.....9-24
10-23 Drain, Fort Du Pont, Del. 10- 1
10-24 Sewers, Seattle, Wash 10- 8
10-26 Sewers, Wilkes-Barre, Pa.....10- 8
10-27 Sewers, etc., New York 10-15
10-28* Sewers, etc., Rye, N. Y..... 9-24
11- 2 Sewer pipe, Selma, Cal.....10- 8
11- 2 Sewer, Washington, D. C.....10-15
11- 2 Sewer, Elizabeth, N. J.....10-15
11- 4* Disposal plant, etc., Wyoming, Ohio 10-15
11-16* Sewers, Hartwell, Ohio.....10-15

STREETS AND ROADS.

10-15 Paving, Rockford, Ill.....10-15
10-16 Road impvt., Cincinnati, Ohio....10-15
10-16 Road, Monticello, Ind. 10- 1
10-16 Road, York, Pa.....10- 8
10-16 Road, Media, Pa.....10- 8
10-16 Road, Carlisle, Pa.....10- 8
10-16 Roadway, etc., Salisbury, N. C..10- 8
10-17 Road, Terre Haute, Ind. 10- 1
10-19 Macadam, etc., Haworth, N. J...10- 1
10-19 Asphalt repair, New York, N. Y.10- 8
10-19 Sidewalks, Ogden, Utah.....10-15
10-19 Road, Kansas City, Kan.....10-15
10-19 Drive, Chicago, Ill.....10-15
10-19 Roads, Hartford, Conn.....10-15
10-20 Curbing, etc., Jefferson City, Mo.10-15
10-20 Grading, etc., Youngstown, Ohio..10-15
10-20 Regulating, etc., Brooklyn, N. Y..10-15
10-21 Repaving, etc., Brooklyn, N. Y..10- 8
10-21 Grading, Cleveland, Ohio.....10- 8
10-21 Paving, etc., Oakland, Cal.....10-15
10-21 Sidewalk, Pleasant Ridge, Ohio...10-15
10-22 Wood blocks, New York, N. Y.....10-15
10-22 Road impvt., Pittsburg, Pa.....10- 8
10-22 Roads, Harrisburg, Pa.....10- 8
10-23 Road impvt., Cincinnati, Ohio...10- 8
10-24 Road, Portland, Ind.....10- 1
10-24 Macadam, Lexington, Ky.....10-15
10-27 Regulating, etc., New York, N. Y.10-15
10-28 Grading, etc., Ottawa, Kan.....10-15
10-28 Regulating, etc., Brooklyn, N. Y.10-15
10-28 Road repair, Toledo, Ohio 10-15
10-31 Road, Greencastle, Ind.....10-15
10-31 Sidewalk, Louisville, Ky.....10-15
11- 2 Roads, Tipton, Ind.....10-15
11- 2 Roads, Greencastle, Ind.....10-15
11- 2 Road, Huntington, Ind.....10-15
11- 7 Road, Kansas City, Kan.....10-15
11- 7 Road, Crawfordsville, Ind.....10-15
11- 9* Roads, Albany, N. Y.....10-15
11-11* Roads, Albany, N. Y.....10-15
11-13* Roads, Albany, N. Y.....10-15

MISCELLANEOUS.

10-16 Dredges, Panama 9-24
10-16 Drainage, Algona, Iowa.....10-15
10-17 Wharf and dredging, Norfolk, Va.10- 1
10-17 Tile ditch, Hartford City, Ind...10- 8
10-19 Fire alarm supplies, New York..10- 8
10-19* Rock-crushing plant, Washington, D. C. 9-24
10-19 Levee work, Memphis, Tenn..... 9-24
10-20* Snow and ice removal, New York, N. Y. .....(Garbage)10- 8
10-20 Steel doors, etc., Philippines....10-15
10-20* Gym. apparatus, Ft. Morgan, Ala.10- 8
10-20 Canal, Ottawa, Ont.....10- 8
10-21 Rails, ties, etc., Georgia (Rys.).10- 1
10-22 Lantern, New London, Conn. 10- 1
10-22 Ry. supplies, tools, Panama.....10- 8
10-23 Jetty, Boston, Mass.....10-15
10-23 Drainage, De Kalb, Ill.....10-15
10-24 Drainage canal, Clarksdale, Miss.10-15
10-26 Engr. supplies, etc., Panama.....10- 8
10-27 Cranes, Panama 10-15
10-28 Locomotives, Panama 10-15
10-29 Iron gates, Wash., D. C.....10-15
10-29 Oil, New York 10-15
10-30* Drainage, Cerro Gordo, Ill.....10-15
10-30* Dredging, Tuckerton, N. J.....10- 8
10-30 Breakwater and dredging, Rondeau, Ont. 10- 8
10-30 Coal shed, Fort Hamilton, N. Y..10- 8
11- 2 Submarines, Wash., D. C..... 8-13
11- 3 Breakwater and dredging, Port Burwell, Ont. 10- 8
11- 9 Battleships, Washington, D. C... 9-17
11-10 Retaining wall, New York 10-15
11-14 Coal-handling plant, Charleston, S. C. 10-15
11-14 Dredging, Galveston, Tex.....10-15
11-17* Lock and dam, Mobile, Ala. 9-17
11-18* Coal tower, San Francisco, Cal..10- 8
11-20* Dredge, Mobile, Ala.....10-15
12- 1 Dredging, Hawaii 9-17

FOREIGN.

10-21 Power plant, Australia 9-10
10-21 Railway, Belgium.....10- 8
10-29 Reservoir, pipe, India 8- 6
11- 2 Electric plant, Chile.....7-16
11- 2 Telegraph material, Australia..... 9-10
11- 4 Reservoir, India 8- 6
11-26 Mines, Turkey 10- 8
12- 1* Sewers, paving, Ecuador..... 8- 6

CIVIL SERVICE.

10-17 Supt. of Bldgs., Wash., D. C....10- 1
10-17 Draftsman, Albany, N. Y.....10- 1
10-17 Inspector, Albany, N. Y.....10- 1
10-17 Health Officer, Albany, N. Y....10- 1
10-19 Highway Ry. and Irrig. Engr., Philippines 9-24
10-21 Mech. draftsman, Wash., D. C..10-24
10-21 Asst. designer, Wash., D. C.... 9-24
10-21 Forest Asst., Philippines..... 9-24
10-28 Mech. examiner, Wash., D. C....10- 8
10-28 Preparator, Washington, D. C.....10-15
11- 5 Bacteriologist, Wash., D. C.....10-15
11- 6 Clerk, New York 10- 8
11- 9 Elec. engr., Wash., D. C.....10-15
11- 9 Lab. chief, Wash., D. C.....10-15
11- 9 Agricultural asst., Wash., D. C...10-15
11-11 Lab. aid, Wash., D. C.....10-15
11-17 Examiners, etc., Wash., D. C.....10-15
11-17 Insp. supplies, San Francisco, Cal. 10-15

RAILWAYS.

AKRON, CANTON & YOUNGSTOWN.—Right-of-way has been acquired by this company for its proposed line between Akron, Ohio, and Mogadore, eight miles. Z. W. Davis, Canton, Ohio, is Pres.

ALTUS, ROSWELL & EL PASO.—We are officially advised that date for letting contracts is indefinite. Company has secured about $750,000 of bonuses. The line will run from Altus, Okla., to El Paso, Tex., via Lubock, Plainview, Tex., and Roswell, N. Mex. As noted on Aug. 27, "H. H. Fielder, Ch. Engr. of the Altus, Roswell & El Paso Ry. Co., writes us that work is progressing rapidly. The first 35 miles of grading between Altus and Hollis, Okla., is now completed, averaging about 12,000 cu. yds. per mile; 3% maximum curvature and a 1% maximum grade. The line, as projected, runs southwest to Lubbock, Tex., in Lubbock County, and west to Roswell, N. Mex.; thence southwest to El Paso, Tex., traversing a rich farming section thickly settled throughout and as yet without railroad facilities. The line crosses the Salt Fork of the Red River four miles west of Altus, where there is to be a 1,700-ft. pile bridge; the bridging of the first 35 miles will average 150 bridge feet per mile. Company is now ready to let contracts for track laying complete with 60 or 65-lb. relay steel, together with bridging; track complete ready for rolling stock over the first division, Altus to Hollis, Okla., with option of continuing as work progresses or as grade is finished. Company invites correspondence from reliable contractors, with a view to bidding on this work. Engineers are now in the field moving toward Roswell. It is expected to soon start grading between Hollis, Okla., and Wellington, Tex., a distance of 25 miles, pushing work as rapidly as possible. Edward Kennedy is Pres.; H. H. Fielder, Ch. Engr., Altus, Okla." Noted on June 4.

ATCHISON, TOPEKA & SANTA FE.—For the first time in the history of the company, there are at present no plans for the construction of extensions to the Atchison, Topeka & Santa Fe Ry., according to the New York "Press." E. P. Ripley, Pres., in his annual report to stockholders, intimates that this policy is due to the hostility shown the railroads by the people and the legislature. Mr. Ripley says some of the improvements work was so far advanced when the business depression set in that it could not be stopped, whereas other work was stopped and will pot be resumed until business conditions show greater improvement. Total operating revenues for the year ending June 30 last were $90,617,796, a decrease of $4,324,879, which Mr. Ripley asserts was about half due to the shortage in the cotton and wheat crops and half due to a reduction in traffic in manufactured articles.

BALTIMORE & OHIO.—The Wilmington (Del.) "Evening Journal" states that a line of track will be laid from Swan Creek to Oakington, Md., on the Pennsylvania R. R., to increase the switching facilities of both systems on the lower side of the Susquehanna River. Another link east of the river is being built from a point near Perrysville, Md., to Aiken, on the B. & O. D. D. Carothers is Ch. Engr. of the B. & O., at Baltimore, Md.

CANADIAN NORTHERN QUEBEC.—Contract for building the extension to Rawdon, Que., ten miles, has been let to J. P. MULLARKEY, of Montreal, Que. The line is to be completed during the present year.

CANADIAN PACIFIC.—At the annual meeting of the Canadian Pacific Railway Co., held in Montreal on Oct. 7, the shareholders voted to ask the sanction of the Governor-in-Council of Canada to the raising of $50,000,000 new capital for the company, bringing the ordinary stock up to $200,000,000. It is not the intention to utilize the power to raise all of the additional capital at once, but to hold most of it in reserve for future developments, which include the extension of the company's Atlantic and Pacific service. The present unissued capital is less than $4,000,000. The new issue is intended as a precautionary measure. The shareholders also voted to ratify the purchase of a controlling interest in the Alberta Railway & Irrigation Co. at a cost of $2,000,000. The property consists of 113 miles of railway, 425,000 acres of land and an important colliery in the Canadian Northwest. Sir Thomas G. Shaughnessy, Pres., in his address said: "It is not easy to designate in advance with any degree of particularity the purposes for which the money will be required, except in the matter of rolling stock. In the ordinary course of events the volume of traffic on your lines should increase with a fair degree of rapidity, and an expansion necessarily involves not only additional cars and locomotives, but enlarged accommodations and greater facilities to care for it at very many new places over your 9,500 miles of railway, and in providing these, large sums of money are quickly absorbed. Fair progress has been made during the year with all the works of construction and improvement that were in hand, but it is very desirable that the several railway lines now being built should be brought to completion before other works of a like character are undertaken. Therefore, your directors have decided to restrict operations in this respect for the present, at any rate."

COLUMBUS, NEW MEXICO & COLORADO.—W. P. Holliday has been appointed chief engineer of this company, with headquarters in Columbus, N. Mex. Surveys are under way. A. O. Bailey, Columbus, is Pres.

DELAWARE & EASTERN.—It is stated W. J. OLIVER & CO., who have a contract for building this line from Grand Gorge, N. Y., northeast to Schenectady, have not yet commenced construction, as sufficient funds to cover this construction have not yet been raised by the promoters. Noted on Sept. 17.

DENVER, LARAMIE & NORTHWESTERN.—A. E. Welby, Vice-Pres., Denver, Colo., advises us that track-laying will commence on Oct. 15. ORMAN & CO., Pueblo, Colo., has a 45-mile contract. About 40 miles are completed. Surveys are made for 202 miles and right-of-way secured for greater portion of this distance. This line eventually will run from Denver to Seattle. Wash., via Laramie, Walcott and Lander, Wyo.; St. Anthony, Jones, Salmon and Lewiston, Idaho. Chas. Scott Johnson is Pres. and E. Buck, Ch. Engr., Denver. Noted on June 18.

GILMORE & PITTSBURG.—A single-track railroad, 120 miles long, will be built from Armstead, Mont., to Gilmore and Salmon City, Idaho. W. A. McCutcheon, Machesney Bldg., Pittsburg, Pa., is Pres. Company has secured right-of-way and has surveyed the proposed line. It will connect with the Oregon Short Line.

GULF & MAGNOLIA NORTHERN.—Incorporated in Arkansas to build from Magnolia, Ark., northwest via Waldo to Hope, 35 miles. W. Y. Foster, Pres., Hope; J. M. Davis, Vice-Pres., Waldo, and J. L. Davies, Treas., Magnolia. The headquarters of the company are at Hope. It is officially stated that engineer not yet engaged, but that negotiations are under way for a survey to begin within 30 days. Capital $1,000,000, with $100,000 subscribed and 5% paid in to cover preliminary work.

KANSAS CITY, MEXICO & ORIENT.—It is planned to have this railroad completed and in operation by Dec. 1 from Sweetwater, Tex., north to Wichita, Kan., 432 miles. A portion of the line from Sweetwater south towards San Angelo has been built, but no definite statement regarding proposed construction can be made at present.

MISSISSIPPI.—It is stated that about nine miles of standard-gage railroad will be built at Union, Miss., in connection with a saw mill for R. J. Buckwalter, of Wingate, La. It will cost about $50,000. J. G. McDONOUGH, of Eau Claire, Wis., has the contract.

MISSOURI, KANSAS & TEXAS.—Press reports state that seven miles of yard track will be built in Dallas and about $200,000 will be expended, including cost of land. The yard capacity will be doubled. J. W. Petheram is Ch. Engr., Dallas; T. S. McDowell is Gen. Supt.

NEW YORK, NEW HAVEN & HARTFORD.—The Court of Appeals, New York, in a decision handed down on Oct. 6, holds that the New York, Westchester & Boston, which is controlled by the New Haven, should obtain a certificate of convenience and necessity from the Public Service Commission before building its road. The judgment and order of the lower court is reversed.

NORTH CAROLINA.—A survey has been made for a railroad from Causey, on the Yadkin division of the Southern Ry., between Sanford and Greensboro, N. C., to a point near Erect, N. C., about 16 miles. Dunlap Bros., Causey, N. C., are interested. Reid Tull, of Causey, is Engr.-in-Charge.

TEXAS.—We are officially informed that contracts probably will be let soon for building a railway from San Antonio to Pleasanton and thence to Rio Grande, 100 miles. Geo. M. Martin, Pleasanton, Tex., is interested in promotion of this project. Company has not been organized or officers elected yet. Surveys are made and right-of-way and capital are practically secured.

WESTERN PACIFIC.—At a recent meeting of the stockholders of the Western Pacific Co., in San Francisco, the action of the board of directors in issuing bonds to the amount of $25,000,000 was approved. This sum will be expended in completing and equipping the main line from Salt Lake City to Oakland. Track has been laid almost as far west as Humboldt Wells, while all the rails are down in California, from 25 miles east of Oroville to Oakland. Considerable work remains to be done on the great Spring Garden tunnel in the Sierras and also on the Flower Lake tunnel in Nevada. A tem-

porary track has been laid at this point, which does not delay the passage of material to be used on the road. It is understood that the Nevada-California-Oregon Ry., purchased by the Gould interests, is to be made a standard-gage line by the Western Pacific to make it easier to haul material to the scene of the work on the Spring Garden tunnel, according to the San Francisco "Call." There is still much work to be done on the terminals in San Francisco; the ferry slips are completed, practically, at Oakland.

ELECTRIC RAILWAYS.

LONG ISLAND CITY, N. Y.—The New York & Queens County Ry. Co. has been granted by the Board of Estimate and Apportionment the franchise which has been pending for some time to construct extensions of its lines to Whitestone and Bayside. The amended contract drawn by the corporation counsel calls for the construction of a double-track line to Bayside and Whitestone, and the franchises are for 25 years, with the privilege of renewing them for 25 years more, the company to pay $500 for each franchise and 3% on the gross receipts for the first five years and 5% thereafter. At the expiration of 50 years, if no agreement is made for a further renewal, the road becomes the property of the city. F. L. Fuller, of Borden Ave., Long Island City, is Gen. Mgr.

NEW YORK, N. Y.—Bids were received as follows on Oct. 12 by J. W. Stevenson, Comr. Bridges, for furnishing and installing the electrical equipment for the overhead trolley system of the Blackwell's Island Bridge over the East River, between the Boroughs of Manhattan and Queens: Cortlandt Engineering Co., $103,800; J. Livingston, Jr., $96,963; Commercial Construction Co., $98,716; Gore Engineering & Constructing Co., $115,243; Lord Electric Co., $98,489; North-Eastern Engineering Co., $139,509; Watson-Flagg Engineering Co., $101,000; E. J. Duggan, 1133 Broadway, New York, $95,845.

ONEONTA, N. Y.—The Oneonta & Mohawk Valley R. R., an electric line connecting Herkimer and Oneonta, was sold on Oct. 9 by auction to Joseph A. Starrett, 1231 Stebbins Ave., New York. The sale was made under mortgage foreclosure brought by the Knickerbocker Trust So., of New York. Mr. Starrett was the only person present who qualified to bid, and his first offer of $200,000, the minimum figure set by the order of the court, was accepted by the referee. The sale was made subject to receivers' certificates and other obligations amounting to more than $300,000.

JERSEY CITY, N. J.—The plans of the Erie Railroad Co. for the electrification of its suburban lines, which have been under discussion for the last four years, are not to be carried out in the near future to any greater extent, according to the New York "Times," than commencing work on the line to Suffern, N. Y., 32 miles, within a few months. This is about 15% of the total work planed. "Upon the success of this first section of electrification will depend the future plans of the road for this work. It has been denied that Mr. Harriman had pledged $14,000,000 for this work of electrification. It was pointed out that it would probably take five years to complete the work, and that this $14,000,000 estimate, made four years ago, was for the electrification of the entire 220 miles upon which the Erie proposes eventually to substitute electricity for steam. What is being done on the Suffern section is in the way of surveys and other preliminary work, which will probably take two months. At the end of that time, it is reported, if the estimates are satisfactory, the work will be put under way."

READING, PA.—Arrangements are being made by the Interstate Railways Co., Mariner and Merchant Bldg., Philadelphia, which controls an electric railway system of about 450 miles in eastern Pennsylvania, to make improvements and extensions, according to the Philadelphia "North American." The Reading Power Co. is to issue $1,500,000 first mortgage bonds, guaranteed by the United Traction Co., of this city. Proceeds of these bonds will be expended on a power plant at Reading, having a capacity of 20,000 KW. This power will operate the lines from that city down to Chestnut Hill, as well as in the Lebanon Valley. Refinancing plans of the Interstate Railways Co., which, it is stated, probably will be underwritten by E. B. Smith & Co., contemplate several extensions of the present system. One of these will be a new line, 20 miles long, from Reading to Hamburg, at a cost of $400,000. The Wilkes-Barre & Wyoming Valley system will be extended from Pittston to Avoca and from Miners Mills to Hudson. Right-of-way has been secured for these three extensions. John A. Rigg, Philadelphia, is Pres., Interstate Rys. Co., Walter A. Rigg, Reading, is Gen. Mgr., United Traction Co.; Thomas A. Wright, is Gen. Supt. W. B. & W. V. T. Co., Wilkes-Barre.

PITTSBURG, PA.—A company has been formed to build a line from Pittsburg to East Liverpool, Ohio, over route 34 miles long. The company is known as the Pittsburg & East Liverpool Electric Ry. Co., and the officers are J. M. Reed of Dravosburg, Pa., Pres.; Rev. A. Moore Buchanan, Morgantown, W. Va., Secy.; and Hon. J. C. McClaren, of Murdocksville, Pa., Treas.

ALTOONA, PA.—Regarding the announcement that the Altoona & Patton Electric Railway Co. will revive the project to build an electric line connecting this city with Patton, Pa., Arthur B. Clark, City Treas., advises us that nothing definite has been done up to this time. The company controls the charter of the Blair & Cambria County St. Ry. Co., providing for a line from Eleventh Ave. and 18th St., Altoona, to Patton. H. P. Wilson of this city is Pres. of the company and F. G. Patterson, also of this city, is Secy.

WASHINGTON, D. C.—The Washington, Arlington & Falls Church Ry. Co. has recorded a mortgage on all of its property to secure an issue of $1,000,000 bonds. The Girard Trust Co., of Philadelphia, is trustee under the mortgage, the object of which is to pay off two previous mortgages, aggregating $350,000, and to devote the remainder to repairs and purchase of new equipment. The company was recently relieved of receivership. T. Garrett is Mgr. and Pur. Agt., Ballston, Va.

MARTINSBURG, W. VA.—J. C. Anderson and R. M. Johnson, of Norfolk, Va., have applied for an electric railway franchise in Martinsburg for the Berkeley Traction Co., which plans to build an electric railway from Shepherdstown, W. Va., via Martinsburg to Winchester, Va.

CLARKSVILLE, GA.—E. S. Hunnicutt, of Clarksville, plans to build 1½ miles of street railway in this town. Estimated cost, $8,000.

JACKSON, GA.—The Middle Georgia Interurban Ry. Co. has a corps of engineers in the field making a survey of its proposed railway from Jackson to Griffin. L. W. Roberts, of Atlanta, and W. F. Smith, of Flovilla, Ga., are in charge of the work. It is estimated that the road will be about 70 miles in length. The line will be built from Griffin, Jackson, Mansfield and Social Circle, with a branch to Flovilla.

JACKSONVILLE, FLA.—John N. C. Stockton, Pres. of the Ortega Land Co., has been granted a franchise by the County Commissioners for an electric railway to be built between Jacksonville and Ortega, five miles.

KENDALLVILLE, IND.—Plans are being formed by the Kendallville, Ligonier & Goshen Traction Co., lately incorporated, to build an electric railway which will connect the following cities: Kendallville, Brimfield, Wawaka, Ligonier, Millersburg, Benton and Goshen. The capital stock is $10,000. The officers are: Elmer E. McGray, Pres., Kendallville; Haines Egbert, Goshen, Vice-Pres.; C. C. Beyer, Kendallville, Secy.-Treas.; T. A. Redmonds, Kendallville, Gen. Counsel. The offices of the company are at 511 South State St., Kendallville.

ELGIN, ILL.—The Elgin, Woodstock & Lake Geneva Ry. Co. has awarded contract to the GEORGE H. PAINTER CO., Chicago, for building its line to connect the places named in its title. It will be about 90 miles long.

CAIRO, ILL.—A charter has been granted to the Cairo & St. Louis Ry. Co. The capital stock is nominally placed at $100,000, and the principal office is to be located in Cairo. It is proposed to build the line from Cairo, through the counties of Alexander, Union, Jackson, Randolph, Monroe and St. Clair to East St. Louis. The incorporators and first Board of Directors are: William B. McKinley, George M. Mattis, W. H. Carnahan and George W. Burton, all of Champaign, Ill., and L. E. Fischer of Danville, Ill.

CLINTON, IOWA.—We are officially advised that surveys are being made by the Central Ry. Co. of Iowa for its proposed line from Clinton to Maquoketa, Garry Owen (Bernard post-office), and Cascade; and Garry Owen to Dubuque, 100 miles. Thos. J. Wilson, Clinton, Iowa, is Pres.; Geo. P. N. Sadler, Attica, Ind., is Ch. Engr. The third-rail system will be used. Contracts for construction will not be let until 1909.

OMAHA, NEB.—The Nebraska Traction & Power Co. has been incorporated at Lincoln, to build an electric railway from South Omaha to Ralston, six miles. A power station will be built at Ralston. Capital stock, $2,000,000. Incorporators: Mel Uhl, J. F. Emmert, W. D. Christ, N. P. Dodge, Jr., and F. N. Howard.

GREAT FALLS, MONT.—G. Calvin Bower, 14 Garfield pl, Poughkeepsie, N. Y., who has been granted franchises for operating an electric railway between Great Falls and Choteau, Mont., 60 miles, advises us that company has not yet been incorporated. Preliminary work only is being done. Surveys are made and right-of-way partly obtained. Capital has not been secured. Previously noted.

W. W. Withes and W. S. Cargill, the purchasers of the Conrad lands north of this city, contemplate the construction of an electric railway running west from the town of Conrad for 25 miles.

EL PASO, TEX.—Richard Caples has applied to the Board of County Commissioners for a franchise for building an electric railway from El Paso to Fabens, Tex.

FORT WORTH, TEX.—Baxter L. Brown, Pierce Bldg., St. Louis, is making survey for the proposed Fort Worth, Weatherford & Mineral Wells Interurban Electric Ry. Stuart Harrison of Fort Worth and others are interested, including the Fort Worth Board of Trade, of which Frank M. Rogers is Pres. The line will be 55 miles long. Noted on Sept. 17.

MARSHALL, TEX.—The Marshall Traction Co. will build a standard gage street railway about three miles long, starting work within three months. Application will be made for a charter. Marvin Turney is interested.

MIAMI, OKLA.—We are officially informed that the Oklahoma, Kansas & Missouri Interurban Ry. Co. will build its proposed railway itself by day labor. Motive power will be gasoline motors. The line will connect Miami and Baxter Springs, Kan., 20 miles. Surveys are made and right-of-way obtained. Franklin M. Smith, Joplin, Mo., is Pres.; John Hall is Ch. Engr., Miami. Company was recently incorporated with $100,000 capital. Noted on Sept. 10.

PROSSER, WASH.—The Prosser Traction Co. probably will begin grading soon on its proposed electric line to be built south from Prosser, with branches to Bickleton and Patterson, Wash., 40 miles. Surveys are now being completed between Prosser and Bickleton, 26 miles. Company will build the first line to Belma, nine miles west of Prosser. Contract will be let for a dam and a power-house. Frank O. Kelsey, of Portland, Ore., is Ch. Engr.; Frederick Finn, of Prosser, is Pres. Noted on Jan. 17, 1907.

CONDON, ORE.—Surveying on the proposed line of the Wasco County Electric Co.'s railroad is being carried on. The route to be followed by the road is through the Maddock Canyon, as an easy grade has been found. Rollo A. Hollenbeck, with a crew of surveyors, are at the John Day River, where one of the proposed dams and electric power plants is to be situated. The same crew will proceed to the Dechutes River, to survey for another dam and power station, 40 miles from Shaniko.

PINCHER CREEK, ALTA.—The Crow's Nest & Prairie Ry. Co. has been incorporated to build an electric railway from the western end of Crow's Nest Lake, easterly through Coleman, Blairmore, Frank, Bellevue, Lundbreck and Cowley to Pincher Creek, Alta. The company has the power to issue $100,000 per mile. J. H. Schofield, Pincher $150,000 in stock and bonds to the extent of Creek, is interested.

LIGHT AND POWER PLANTS.

(denotes that this work is advertised in Engineering News.)*

NEW YORK, N. Y.—See under Electric Railways.

NEW YORK, N. Y.—Bids are asked until 3 p. m., Oct. 26, by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Education, for installing electric equipment in addition to and alterations in Public School No. 132, on the easterly side of Wadsworth Ave., between 182d and 183d Sts., Boro. of Manhattan.

NEW YORK, N. Y.—Bids were received as follows on Oct. 5 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Education, for installing electrical equipment in Public School No. 157, Boro. of Brooklyn: T. FREDERIC JACKSON, INC., 592 Columbia Ave., $13,993 (awarded contract); Commercial Const. Co., 314 West 28th St., $14,752; A. Feldman Const. Co., 1 Madison Ave., $16,-260; Reis & O'Donovan, 1123 Broadway, $14,-869; Peet & Powers, $14,863; E. J. Duggan, 1133 Broadway, $15,380.

Plans have been filed for a 1-story electric light station to be built on Blackwell's Island, near the west pier of the Queensboro Bridge, to supply light to the island institutions under the supervision of the Commissioner of Charities. It is to have a frontage of 31 ft. and a depth of 56 ft., and will be built of Greenwich green stone set in broken bond. It is to cost $5,000, according to the estimate of Raymond F. Almirall, Arch., 51 Chambers St.

NEW YORK, N. Y.—We are officially advised that the P. J. CARLIN CONSTRUCTION CO., 16 East 23d St., Manhattan, has the contract and will start work at once on construction of Sub-station No. 19 at 38th St. and Fifth Ave., Brooklyn, for the Brooklyn Rapid Transit Co. The building will have its equipment placed in a mezzanine gallery. The structure will be 50 × 100 ft. and will cost, with equipment, $200,000. It will be constructed of repressed brick and terra-cotta and its walls will be lined within with white porcelain tiles. W. S. Menden, Brooklyn, is Ch. Engr.

DUNKIRK, N. Y.—The Board of Water Commissioners has awarded a contract to the ALLIS-CHALMERS CO., of Milwaukee, Wis., for installing a new turbo-generator set in the municipal electric light plant, to cost $14,997. The machine will be a duplicate of the one installed six months ago.

BROADALBIN, N. Y.—The Public Service Commission, Second District, ha sauthorized the Broadalbin Electric Light & Power Co. to issue capital stock to the amount of $42,-500 and $10,000 in bonds, the proceeds of both stocks and bonds to be used to pay the obligations of the company, amounting to $13,788, the remainder to be used for the construction of a dam, power-house, equipment and transmission lines.

BUFFALO, N. Y.—The city of Buffalo, through the City Council, has instructed Francis G. Ward, City and County Bldg., Comr. of Public Works, to have specifications prepared for furnishing and installing an engine and generator at the Hamburg Canal pumping station for the purpose of furnishing light and power.

BUFFALO, N. Y.—See item under Manufacturing Plants.

JAMESTOWN, N. Y.—We are officially advised that the Mayor and Commissioners are considering the question of installing a municipal steam heating plant for commercial purposes, in connection with the present electric light plant. It is intended to use the steam utilized in generating power. C. G. Jones is City Engr.

SYRACUSE, N. Y.—The Syracuse, Lake Shore & Northern R. R. Co., Syracuse, N. Y., will erect two power sub-stations, one near Phoenix, N. Y., and one near Fulton, N. Y. Each building will be one story, 60 × 80 ft., of brick and steel construction. William B. Rockwell, Syracuse, is Gen. Mgr.

NORRISTOWN, PA.—The contract for making the necessary changes in the power-house and the installation of 250 arc lamps has been awarded to the WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa., by the Borough Council. The present street lighting system will be replaced by 4-amp. luminous arc lamps.

WASHINGTON, D. C.—Capital Traction Co. awarded contract for erection of sub-station at First and B Sts S. W., to JAMES L. PARSONS, Pennsylvania Ave. and 13½ St. N. W., Washington. Estimated cost, $30,000. D. S. Carll, Washington, is Supt.

DANVILLE, VA.—We are officially advised that the city has appropriated $22,000 for a central lighting plant. Improvements will consist of additional boiler, 500-KW. steam turbine generator, etc. The contract has been awarded to the ALLIS-CHALMERS CO., Milwaukee, Wis. Frank Talbott is Supt. Water, Gas and Electric Dept.

SCOTTSBURG, VA.—Talley's Falls Improvement Co., M. R. Lewis, Engr.-in-Charge, is planning development of water-power of Talley's Falls, on Dan River, five miles from Scottsburg. [illegible] 12,000 HP. is available for [illegible] electricity to manufacturin[illegible] plants in Virginia and Nor[illegible] cluding copper mining prop[illegible] ginia-Carolina copper belt. [illegible] that $1,000,000 will be th[illegible] electric plant, transmission [illegible]

BROOKE, VA.—We are [illegible] that the Austin Run Minin[illegible] Bldg., Philadelphia, Pa., is [illegible] stall power plant at Brook[illegible] its iron pyrites mines and [illegible] about Nov. 1. The plant [illegible] 70-HP. steam engine, two [illegible] air compressor, air drills, [illegible] etc. A. E. Norton, 1530 Di[illegible] delphia, Pa., is Secy.

EAST DURHAM, N. C.—T[illegible] ton Mfg. Co. is preparing to [illegible] machinery for operating its [illegible] ment. The company is to ex[illegible] erection of boiler and engine [illegible] stallation of 750-HP. engine, [illegible] etc. It will build a 1,500,00[illegible] voir, etc.

MILLEN, GA.—J. B. Mc[illegible] Y & CO., Empire Bldg., Atlanta, G[illegible] ve been awarded the contract for [illegible] ucting a lighting plant and water-w[illegible] system in Millen. W. O. Lumpkin wil[illegible] e charge of the work.

PENSACOLA, FLA.—Survey[illegible] ave been made on the property adjace[illegible] Turner's Mill Pond for the installation [illegible] a hydro-electric plant. It is proposed [illegible] construct two reinforced-concrete dams [illegible] a power plant to be operated by two w[illegible] Robert Graveley, of Mobile, A[illegible] is Engr.-in-Charge.

*UNIVERSITY, ALA.—Bids [illegible] asked at the office of John W. Abercrombie, Pres. University of Alabama, until [illegible] m., Oct. 24, for furnishing engineering laboratory and power plant equipment for engineering building, also for furnishing material and constructing a central heating system.

ALBERTVILLE, ALA.—The Sand Mountain Electric Co. will begin at once construction of a system for lighting the city with electricity. The company will construct 3½ miles of transmission line.

ENSLEY, ALA.—The U. S. Steel Corporation has authorized improvements made to the plant of the Tennessee Coal & Coke Co., at Ensley, Ala., which will involve an expenditure of about $2,000,000. Among the improvements contemplated is the erection of an electrical repair shop and the installation of additional electrical machinery. G. G. Crawford is Gen. Mgr.

WINNFIELD, LA.—H. W. Wright has been appointed by the city to superintend the construction of the electric light plant and water-works.

SPARTA, TENN.—O. H. Anderson, J. R. Tubb and others have purchased and will develop water-power properties about one mile from Sparta. A dam will be built at once. Electric power will be transmitted to Sparta. Cost of development, about $25,000.

DECKER, IND.—Eugene Rush, of Frankfort, Ind., is at the head of a syndicate which intends to erect a water-power plant near Decker, on White River. It is stated that work on the undertaking will begin as soon as Congress has granted permission to the company the right to proceed. Mr. Rush is securing engineering data. He has measured the velocity of the stream at the site of the proposed dam at every variation of stage, this work having been carried on since the flood in January until the extreme low stage was reached last week.

CHICAGO, ILL.—We are officially advised that the Cosmopolitan Electric Co. will construct a fireproof power plant, 124 × 168 ft., at Chicago River, Grove and 16th St. D. H. Burnham & Co., Railway Exchange Bldg., is Arch. Cost, $300,000.

MUSCATINE, IOWA.—According to the Davenport (Iowa) "Democrat," a water-power canal from Moscow, Iowa, to Muscatine, will be built. New officers have been elected by the Independent Power Co., which is behind the project, and a board of directors chosen. The officers are: W. L. Roach, Pres.; J. L. Giesler, Vice-Pres.; P. W. Francis, Secy.; C. R. Musser, Treas. W. L. Roach, C. R. Musser, P. W. Francis, Arthur Hoffman, J. L. Giesler, S. G. Stein, Nick Barry, Dirs. Engineers from J. N. Young & Co., Chicago, are here making final survey in the interest of eastern capitalists who, it is understood, have an agreement with the Muscatine company to take over the $2,000,000 worth of bonds of the canal if the survey verifies the previous surveys. They also ask that money be subscribed in Muscatine. This amount has been advanced. The Cedar River at Moscow is 90 ft. higher than the Mississippi River at Muscatine, 14 miles away. About 20,000 HP. will be developed by the canal which is to be constructed. An interurban from Muscatine to Iowa City will use power. Manufacturing concerns here and new industries will use the greater part. It will take 1½ to 2 years to complete the canal.

GREAT FALLS, MONT.—We are officially advised that plans are being completed by Charles T. Main, Engr., 45 Milk St., Boston, Mass., for the immediate development of two powers near Great Falls. The upper development is to be made at the falls known as Coulter's, Crooked and Rainbow, situated about three miles down the river from Great Falls. At this point the head will be about 105 ft. A crib dam about 25 ft. high will be built with masonry head gate, and waste gate structures. A steel penstock 22 ft. in diameter and about 2,500 ft. long will extend from the intake to the power-house. The latter will be of masonry construction containing about 36,000 HP. of wheels and electrical apparatus. The lower development is about twelve miles below Great Falls. Here the fall is about the same as at the upper development. The dam will be of the same construction as at Rainbow Falls, the canal being 500 ft. long, and directly below this, the power-house. The equipment will be a duplication of that at the upper devel-

opment. The engineering corps is engaged in making surveys and in the preparation of plans. The work on the coffer dams is already under way and it is expected to proceed with the rapidity of development to completion as fast as power is developed. A portion of the power will be used at the Boston & Montana Smelter at Great Falls, Mont. The balance will be transmitted to more distant places.

BUTTE, MONT.—The Madison River Power Co. is planning to erect steel towers to replace the wooden poles which now support the line of its transmission line from its plant on the Madison River. The transmission line will be 61 miles in length and will cost about $250,000. Work will be pushed on the construction of the line at once.

HUBBARD CITY, TEX.—The Union Central Life Insurance Co. has secured the necessary franchises and will construct proposed extensions to the four surrounding towns, to furnish electric light, power, etc. About $75,000 of bonds will be issued.

CANON CITY, COLO.—D. De Weese has begun work on the De Weese power conduit, tunnels, which will develop pipe, electric power plant and then water to Grape Creek to be used return for the irrigation of several thousand acres in Townships nineteen, south of this city. The system is composed of over 15 miles of pipe, tunnels and open ditch. The tunnels will be 7,000 ft., and built at a 2-ft. grade. The open ditch will be 6 ft. at bottom, 10 ft. at top and 5 ft. deep. The pressure pipe will be 42 ins. in diameter, and conduct the water to the wheels of the Pelton type, for generating electric power for lighting and power purposes. The pipes will have a capacity of 60 cu. ft. per sec. of time. The water will be taken from the De Weese reservoir on Grape Creek, 16 miles above Canon City. The power plant will be about four miles above the city. The total improvement will cost $425,000.

FORT BAYARD, N. MEX.—Bids are asked by Capt. S. P. Vestal, Const. Q. M., until Oct. 23, for furnishing and installing electric light fixtures in the Administration Building at Fort Bayard.

SANTA FE, N. MEX.—J. P. Connor advises us that he has made application to the Territorial Engineer to take all the water from the Pecos River, which is 450 cu. ft. per sec., with a fall of 110 ft. in 90 chains. There is a 4-ft. vein of coal that can be mined and trimmed in the power-house. Estimated cost, $200,000.

KENNEWICK, WASH.—The Northwest Light & Water Co. has entered into a contract with the Northern Pacific Irrigation Co. to furnish electricity for operating the pumps of the irrigation system of the latter company. The contract provides for installation of a steam power plant as an auxiliary to a transmission line to be erected from the hydro-electric plant of the Northwest Light & Power Co., located on the Natchez River in Kennewick. Pumps will be installed and pipe lines constructed at once. Orders have been placed for the transmission line, and it is expected to have the system completed before April 1, 1909. R. E. Strahorn is Pres. of the power company.

BELLINGHAM, WASH.—Surveys are under way on the upper Skagit River for the installation of water-power plants to develop 75,000 to 100,000 HP. Water rights have been taken out on the Skagit, and all its tributaries, above Bacon Creek. The first plant will be erected at the intersection of Skagit River and Bacon Creek, to develop about 10,000 HP., from which power will be obtained to push the work farther up the river. C. L. Mitton, C. E., is now running a line for the 3-mile tunnel at Rockport, to secure a 200-ft. fall at that point. Water rights have been filed by A. Freeman, of Anacortes, and B. Thomas, Consult. Engr. for the Seattle Electric Co.

NAPA, CAL.—Bids are asked until Nov. 11 by the Supervisors of Napa County for a franchise to conduct a farmers' power line from Napa into Lake County, through the Napa Valley. It is stated that E. D. N. Lehe, of Woodland, is promoting the system and will bid for the franchise. He proposes to supply power for electric lights and for pumping water, etc. Yountville, Oakville and Rutherford are among the towns above Napa which will be reached by the new system.

ORLAND, CAL.—Bids were received on Sept. 29 by D. C. Henny, Superv. Engr., and T. H. Humphreys, Res. Engr., for the construction of the East Park dam and dikes in connection with the Orland irrigation project. The bidders and amounts are as follows: Standard Building Co., 440 Commercial St., San Francisco, $89,021; Cotton Bros. Co., Bacon Bldg., Oakland, $122,463; Edward Malley, San Francisco, $83,980; Johnson W. Porter, Vancouver, Wash., $167,500; Hunkin Bros. Construction Co., Cleveland, Ohio, $215,260; Bates-Rogers Construction Co., Chicago, $122,935; Stanley Contracting Co., San Francisco, $79,319; Maney Brothers & Co., Winnemucca, Nev., $147,285; Summit Construction Co., San Francisco, $130,883; Burrell Bridge & Construction Co., Oakland, $130,250; W. O. Morrison, Denver, Colo., $160,200; Union Iron Works, Los Angeles, Cal., $113,817.50; Globe Construction Co., San Francisco, $112,180; F. M. Butler, San Francisco, $97,687; Daniel O'Day Co., 90 Belcher St., San Francisco, $69,000; Latus & Layaz, Oakland, $64,383.

SONORA, CAL.—The Tuolumne Power & Light Co., John C. Hays, Pres., has made locations of water rights and reservoir sites on the Tuolumne River in the vicinity of Hetch Hetchy. The whole of Poopenaut Valley on the river below Hetch Hetchy, has been located as a reservoir site. The rights located are as follows: Water right of 25,000 cu. ft. of water of Tuolumne River, with the point of diversion 3,000 ft. below Poopenaut Valley. Water right of 10,000 ins. located by S. L. Stoval for company, April 28, 1908, on the middle fork of the Tuolumne River, water to be stored at Stone Meadows. Water right of 10,000 ins. originally located by J. B. Curtin and E. E. Newell, April 20, 1908, on the south fork of the Tuolumne River and to be stored in Stone Meadows and also in Ackerson Meadows. Water right 10,000 ins. of water from the south fork of the Tuolumne River located by S. L. Stovall. Location of a reservoir site containing 533.23 acres in Sections 23, 24, 25 and 26, T. 1 S., R. 19 E., known as Ackerson Meadows, north of Sequoia. The dam here will be built 100 ft. high. Reservoir location of 300 acres in Sections 17, 19, 20 and 30, T. 1 N., R. 20 E., being the whole of Poopenaut Valley. The water here will be stored by a dam 150 ft. high. Reservoir site containing 262.62 acres in Stone Meadow in Sections 14, 15, 22 and 23, south of Hetch Hetchy. The dam at this site will be 120 ft. high. All of the above locations are now the property of the said Tuolumne Power & Light Co., and the stated purpose of using the water is for irrigation and electric power. Power-houses will be located at three different points for the generation of electric power, as follows: One on the Tuolumne River in Section 23, T. 1 S., R. 18 E.; at the junction of the middle and north fork of the Tuolumne River; in Section 2, T. 1 S., R. 15 E., near Wards Ferry. The plan is to convey the water along the left bank to the middle fork power-house, thence to the second and third power-houses respectively.

BIGPINE, CAL.—Work is to commence soon on the installation of the Bigpine electric plant. Baker Creek, otherwise known as Turner Creek, has been taken up by a San Francisco syndicate headed by Charles D. Lane of the Utica Mine. Mr. Lane will complete all arrangements and supervise the preliminary details of the undertaking. The water-power on Baker Creek has a backing of 400 ins. of water and a fall of 2,500 ft. This fall is broken into three separate falls, the highest of which is 1,342 ft., which is known as the middle fall, and in this fall the company expects to develop 1,200 HP. Besides the power rights on this creek, the company has been given a site for its plant in Baker Canyon.

HUNTSVILLE, UTAH.—A force of men has been sent to South Fork Canyon, above Huntsville, where preliminary work is under way for a pipe line in connection with a power plant to be operated in Ogden. The system is to be under the direct supervision of L. B. Spencer, Engr., who controls water rights adjoining those of the city in South Fork Canyon. The immediate purpose is said to be to provide light and power for the block bounded by 24th and 25th Sts. and Washington and Grant Aves. In a distance of 10,000 running ft. a fall of more than 500 ft. is secured and it is stated it will be purely a gravity proposition, which will involve an expenditure of more than $150,000.

ST. ANTHONY, IDAHO.—J. M. DeCoster has located a water-power site on the Teton River and is promoting an electric power proposition in Freemont County. The site is about 22 miles east of St. Anthony, where at mean low water the river, it is estimated, will furnish 14,100 HP.

BRIDGES.

(denotes that this work is advertised in Engineering News.)*

ALBANY, N. Y.—F. C. Stevens, Comr. Pub. Wks., Albany, has awarded Contract No. 13, which is for furnishing and erecting five steel highway bridge superstructures at various points on the Barge Canal, to the PENN BRIDGE CO., of Beaver Falls, Pa., at $23,676. List of bidders noted last week.

WESTFIELD, N. Y.—The citizens have voted in favor of expending $35,000 for the construction of a viaduct 1,050 ft. long and 50 ft. wide, over Chautauqua Creek at Main St., the Buffalo & Lake Erie Traction Co. to pay the remainder of the estimated cost, $75,000.

JERSEY CITY, N. J.—F. M. STILLMAN, 21 Exchange Pl., Jersey City, has secured the contract (bids opened on Sept. 17) for constructing a bridge over the Hackensack River from Newark Ave., Jersey City, to Newark Turnpike Road in Kearney Township at $313,000, the bridge to consist of three fixed spans, 180 ft. center to center of end bearings and one draw span 248 ft. center to center of end wedge seats, and 255 ft. diameter of swing piers and abutments of concrete on piles. List of bidders noted on Sept. 24.

YORK, PA.—We are officially advised that the YORK BRIDGE CO., York, Pa., has been awarded the contract by the County Commissioners, York, for constructing the superstructure of a bridge across Codorus Creek near Porter's Siding, substructure to consist of two stone abutments, two wing walls, one 25 ft. and the other 23 ft. long, the superstructure to be of steel 84 ft. long, 14 ft. roadway and a capacity of 1,750 lbs. per lin. ft. The contract for the substructure was awarded to HENRY W. REILY. Bids were opened on Oct. 7. C. B. King is Clk.

NORRISTOWN, PA.—The County Commissioners on Oct. 3 awarded contracts for the erection of three bridges in the county as follows: TOLEDO-MASSILLON BRIDGE CO., Toledo, Ohio, bridge over the Skippack Creek, at $6.10 per cu. yd. JAMES SMITH, Perkiomenville, Pa., bridge over Skippack Creek near Bergey's mill, at $5.42 per cu. yd. John H. Dager is Engr.

BALTIMORE, MD.—The city contemplates constructing two bridges, one across Slingluff Ave. and the other over the Western Maryland R. R., in connection with the improvement of Liberty Road. B. T. Fendall is City Engr.

*LYNCHBURG, VA.—Bids will be received by the Council Committee on Streets until noon, Oct. 26, for placing new stringers under street car tracks, and lacing top chords, Rivermont Viaduct. The approximate quantities of the work to be done are as follows: 101.5 tons channels in stringers, 6.4 tons lace bars; 18,260 ft. B. M. lumber. Plans can be seen, specifications and forms of proposals and contracts obtained, at the office of the City Engineer, Lynchburg. H. L. Shaner is City Engr.

GLENDON, N. C.—R. W. CURTIS has been awarded the contract by the Commissioners of Moore County for the construction of a bridge here at about $5,400.

CHAPPELLS, S. C.—Bids are asked by the Counties of Newberry and Saluda, until Oct. 16 for the construction of a bridge over the Saluda River at Chappells Depot. J. Monroe Wicker is Superv., Newberry County.

SAVANNAH, GA.—JOHN ROURKE & SONS, of Savannah, have been awarded the contract for constructing 15 steel pontoons and 15 33-ft. sections of pipe line for use of the Government dredge Morgan, at $8,647, of which $7,545 is for pontoons and $1,102 for pipe lines. Col. Dan C. Kingman, Corps Engrs., U. S. A., is Engr.

AUGUSTA, GA.—Nisbet Wingfield, Comr., Augusta, is preparing plans and specifications for rebuilding the Center St. bridge, structure to be of steel. Estimated cost, about $50,000. The drawbridge system will probably be used.

KNOXVILLE, TENN.—J. W. PETTIS has been awarded the contract by the County Board for repairing the bridge on the Hardin Valley Road near Norman's.

J. A. BLAIR has secured contract to repair all of the bridges within six miles of Knoxville, not including the "forks" of the river, at $23.90 M. B. M. for lumber without painting, and iron at 7 cts. per lb.

M. E. MAYNARD was awarded the contract to repair all the bridges in the Fourth and Fifteenth Districts, within six miles of Knoxville, at the same price, including half of the Boyd's bridge over the Holston River.

PARIS, KY.—The CHAMPION BRIDGE CO. of Wilmington, Ohio, secured the contract on Sept. 26 for constructing a steel bridge over Silas Creek, at $7,400.

SABINA, OHIO.—Bids will be received until Oct. 24 by J. M. Fisher, County Audr., Wilmington, Ohio, for furnishing material and reinforcing the substructure and constructing a new superstructure over Little Rattle Snake Creek at Howard St., Sabina, to consist of a steel bridge, 85 x 20 ft., with concrete floor and 5-ft. walk with concrete floor.

TOLEDO, OHIO.—We are officially advised that BROGHAN & RYAN, Whitehouse, Ohio, have been awarded contracts for constructing abutments for bridges in Springfield, Swanton and Waterville Townships, at $5.25, $5.78 and $5.38 per cu. yd. Joseph Hofman is County Surv.

VENICE, OHIO.—Bids are asked until noon, Oct. 23, by the County Commissioners, Cincinnati, Ohio, for repairing the floor of the bridge over the Great Miami River here. Fred Driehs is Clk. Comrs.

MISHAWAKA, IND.—The County Commissioners have taken steps toward the construction of a bridge over the river at Logan St.

GREENSBURG, IND.—The Commissioners of Decatur County will soon ask for bids for the construction of a bridge over Haw Creek at Clifty. Estimated cost, $8,000.

*MUNCIE, ILL.—We are officially advised that bids were received as follows, on Oct. 7, by the Commissioners for the construction of a reinforced concrete arch of 18-ft. span and 16-ft. roadway over Stony Creek, one-half mile east of here: H. F. BURKE, New Castle, Ind., $3,480 (awarded contract); George A. Davis, Danville, Ill., $4,550; Illinois Bridge Co., Chicago, Ill., $4,870; same, on a design of their own, $3,970; Payne & Benson, Danville, Ill., $4,144; Fred C. Harper, Terre Haute, Ind., $4,597; E. E. Schwartz, Chicago, Ill., $4,190; Advance Construction Co., Waukesha, Wis., $3,980, and 28¾ cts. per yd. for fill and approach grade; William P. Carmichael, Williamsport, Ind., for bridge alone, $3,880; for bridge and fill, $4,380. John F. Fisher, Danville, Ill., is Engr.

FORT ATKINSON, WIS.—The DORNFELDT-KUNERT CO., of Watertown, Wis., has secured the contract for constructing the Roberts St. bridge here at $8,765.

SUPERIOR, WIS.—The Lake Superior Terminal & Transfer Ry. Co. on Oct. 3 decided to construct its share of the Belknap viaduct, providing the other roads stood their proportion of the cost of constructing the approach. D. M. Philbin, Superior, is Pres.

MILWAUKEE, WIS.—The County Supervisors on Sept. 29 awarded the contract for the completion of the Grand Ave. viaduct to the NATIONAL ENGINEERING & CONSTRUCTION CO., Milwaukee, at $372,000. Noted Oct. 1.

GREEN BAY, WIS.—We are officially advised that a bridge will be constructed by the city over the Fox River at Walnut St., 28-ft. roadway, four fixed spans 140 ft. each, and one movable span, 114 ft. Estimated cost, $150,000. The Strauss Bascule & Concrete Bridge Co., 903 Fort Dearborn Bldg., Chicago, Ill., are Designing Engrs. Noted Sept. 24.

CHARLES CITY, IOWA.—Bids, plans and specifications will be received by the Board of Supervisors of Floyd County, at the office of H. B. Rosenkrans, County Audr., until 10 a. m., Nov. 12, for the construction of a steel concrete bridge, approximately 262 ft. long, 73 ft. wide, across the Cedar River, on Main St. J. G. Cutler is Chn. Bd.

WINFIELD, KAN.—Bids will be received until noon, Oct. 19, by P. G. Paddock, Vernon Township, Winfield, for constructing two concrete bridges over Spring Creek in Vernon Township.

MANHATTAN, KAN.—We are officially advised that the contract has been awarded by the county to the CANTON BRIDGE CO., Canton, Ohio, for the construction of a 100-ft. span bridge with a concrete floor, a 20-ft. span with plank floor and a 60-ft. span with plank floor at $7,000. Bids were opened on Oct. 9. George H. Hungerford is County Clk.

OTTAWA, KAN.—We are officially advised that EARL WILBURN has been awarded the contract at 14 cts. per cu. ft. for constructing stone piers for a bridge in Peoria Township. Bids were opened on Oct. 3.

NEWARK, ARK.—Bids are asked until Oct. 22 by Independence County for the construction of a steel bridge over "Island Slough," near here, the bridge to be 120 ft. long with a 12-ft. roadway, concrete or stone piers. S. B. Wycough is County Judge.

HAMLIN, TEX.—The city of Hamlin and Stonewall County will construct jointly a 350-ft. wooden-trestle bridge across the Brazos River on the road from Hamlin to Aspermont, Tex. The contract has been awarded the AUSTIN BRIDGE CO., Dallas, Tex.

*AUSTIN, TEX.—Bids will be received by the Commissioners' Court of Travis County, at Austin, until 11.30 a. m., Nov. 5, for furnishing the necessary labor and materials for constructing a reinforced-concrete arch bridge over the Colorado River on Congress Ave., and for the removal of the steel bridge now there, all in accordance with plans and specifications on file with the County Judge of Travis County. The bridge will consist of eight spans, each 110 ft. long at the springing line and having a roadway 38 ft. wide and two sidewalks each 5 ft. wide. Copies of the plans and specifications will be furnished upon application to County Judge, or to Waddell & Harrington, Consulting Engrs., Kansas City, Mo. John W. Hornsby is County Judge.

EVERETT, WASH.—C. G. SHEELY, McPhee Bldg., Denver, Colo., has been awarded the contract by the County Commissioners for the construction of the steel bridge across the Stillageamish River below Stanwood, at $16,970.

STOCKTON, CAL.—We are officially advised that contracts for the construction of bridges were awarded as follows on Oct. 6 by the Board of Supervisors of San Joaquin County: Hunt bridge, to C. G. SHEELY, McPhee Bldg., Denver, Colo., at $7,703; Paradise Cut bridge, to M. B. WHITE, at $14,000. F. E. Quail is County Engr.

SANDPOINT, IDAHO.—Bids will soon be asked by the County Commissioners for the construction of a bridge across Hoodoo Creek.

VICTORIA, B. C.—The Provincial Government is having plans prepared for the construction of a steel bridge across the Elk River at Fernie, B. C., a steel bridge across the same river at Hosmer, B. C., and for a court-house at Fernie. These three structures were destroyed in the Fernie forest fires.

BUILDINGS.

(denotes that this work is advertised in Engineering News.)*

PORTLAND, ME.—We are officially advised that the ABERTHAW CONSTRUCTION CO., 8 Beacon St., Boston, Mass., has been awarded the general contract for the erection of a 6-story reinforced-concrete store and office building for J. P. Baxter, at Portland, Me. This company has received orders for the brick, and finished carpentry work and the metal lath partitions. It will be in the market for metal lath.

At a meeting of the City Council, held on Oct. 5, it was voted to adopt the plans recommended by the City Hall Commission for the construction of a city hall and auditorium. The plans call for the expenditure of nearly $900,000. The Commission submitted two plans for an auditorium, one with a seating capacity of 2,000, and the other for 3,000. The Council voted to build one that will seat not less than 2,500.

BUFFALO, N. Y.—Enos & Sanderson, wholesale hardware dealers, have let contracts through Colson & Hudson, Archs., 35 Dun Bldg., for a 2-story and basement brick warehouse, 105 x 195 ft., of mill construction, at Swan and Center Sts. JOHN LANNON, 667 Oak St., secured the mason contract and JOSEPH METZ & SON, 327 Clinton St., the carpentry contract. The cost of the building will be $60,000.

The Buffalo Harbor Land Co. is having plans prepared for a 2-story and basement storage warehouse, 75 x 300 ft., to be erected on the harbor front at the foot of South Michigan St. It is to be constructed of concrete and structural iron. In connection with the warehouse a pile and timber slip and bulkhead 2,000 ft. long will be built. Cost, approximating $75,000. J. Tallman Budd is Pres. of the company, Niagara Hotel, Buffalo; Tiffany & Gail, Consulting Engineers, 1010 Mutual Life Bldg., will receive bids after Jan. 1.

SCHENECTADY, N. Y.—Bids are asked by the Board of Supervisors, at the office of John H. Peters, Clerk, 311 State St., until noon, Nov. 10, for the general construction of the Schenectady County courthouse. Stoddart & Weathers, 31 Union Sq., New York, are Archs.

LONG BEACH (L. I.), N. Y.—J. L. de Saules, of New York, and Henry L. Gillespie, of the T. A. Gillespie Co., contractors, of Pittsburg, Pa., have formed a corporation, to be known as the Nassau Hotel Co., which will commence immediately the erection of a steel and concrete terra cotta trimmed hotel at Long Beach, L. I. It will cost, exclusive of the land, $800,000, and will be in about the center of the completed section of the 2½ miles of 50-ft. boardwalk. It will front 300 ft. on the boardwalk and 150 ft. on National Boulevard. The building is to be erected in the shape of a U, the open side facing the ocean, in order to get a maximum number of rooms with that exposure. The central portion of the ground floor of the building will be occupied by stores facing the boardwalk. The easterly end of the building will have the main entrance to the hotel and will contain a spacious lobby opening on three sides to broad verandas overlooking the ocean and the tennis courts and grounds of the Long Beach Hotel. The westerly end will be occupied by the main dining room, with seating capacity of over 1,000 people, and a broad terrace in front overlooking the ocean and boardwalk. There will be 300 rooms in the hotel, every room with direct outside exposure and running water.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Oct. 23, by John F. Ahearn, Pres. Boro. of Manhattan, for alterations in rooms on sixth and seventh floors; also for exten-

sion to the electric lighting equipment; for carpentry and cabinet work, hardware, metallic and other furniture, painting, electric lighting fixtures, marble and bronze work, plastering, fireproofing and other work in the Hall of Records Building, New York.

NEW YORK, N. Y.—Bids are asked until 10:30 a. m., Oct. 21, by Nicholas J. Hayes, Fire Comr., for furnishing all labor and materials required for additions and alterations to building of Volunteer Hook and Ladder Company Rescue No. 1, located on the north side of Grove St., 250 ft. west of Main St., Flushing; for additions and alterations to building of Murray Hill Volunteer Hose Company No. 4, located at the junction of Madison Ave. and Long Island R. R., Murray Hill, Flushing; for additions and alterations to the building of the Volunteer Mutual Engine Company No. 1, located on the west side of Union St., between railroad and Amity St., Flushing; for additions and alterations to the building of Volunteer Empire Hose Company No. 1, located on the south side of Lincoln Ave., between Main and Garden Sts., Flushing; for additions and alterations to building of Volunteer Eagle Hook and Ladder Company No. 1 and Union Hose Co. No. 1, located on the west side of 16th St., 100 ft. west of Fourth Ave., College Point.

The Benson Realty Co. has filed plans for six 6-story tenements, each 40 × 87.11 ft., to be erected on the north side of 101st St., 100 ft. west of Third Ave. C. B. Meyers, 1 Union Sq., is Arch. Estimated cost, $270,000.

Plans also have been filed for a 6-story apartment house to be built by Gross & Herbner, Broadway and 140th St., at the corner of Amsterdam Ave. and 111th St., opposite the Leake and Watts Orphan Asylum. It will have a frontage of 95.11 ft. and a depth of 115 ft., with accommodations for thirty families. It is to cost $200,000. Neville & Bagge, 217 West 125th St., are Archs.

NEW YORK, N. Y.—We are officially advised that the TURNER CONSTRUCTION CO., 11 Broadway, has been awarded contract by the New York Central & Hudson River R. R. Co., G. W. Kittredge, Ch. Engr., for the reinforced-concrete floors in connection with the new Grand Central Station work. This contract includes the baggage room floor and the roof of the northeast wing of the new station. A total of about 45,000 sq. ft. of floor will be constructed. This company also has been awarded a contract for the reinforced-concrete floor and roof slabs, as well as for the fireproofing of the exposed steel work, in the Maxine Elliott Theater now under construction at 107 to 113 West 39th St., New York, according to the plans of Marshall & Fox, Archs., First National Bank Bldg., and JOHN McKEEFRY, general contractor, 1416 Broadway, New York. Work will be started on both contracts at once.

An 8-story apartment house is to be built by the Harvard Realty Co., James E. Goldberg, Pres., on 111th St., west of Broadway. The structure is to be 50 ft. front and 100.11 ft. deep. William L. Rouse, 11 East 43d St., is Arch. Cost, $150,000.

Paterno Bros., Inc., 54 Morningside Ave. West, have filed plans for three 8-story apartment houses to be erected on 114th St., west of Amsterdam Ave., overlooking the Columbia University grounds. Each house will have frontage of 75 ft. and will have four apartments on a floor. The estimated cost of the three buildings is $540,000. Schwartz & Gross, 35 West 21st St., are Archs.

NEW YORK, N. Y.—Bids are asked until 2:30 p. m., Oct. 20, for providing all labor and materials, including chambers, cars, formaldehyde retorts, transfer table, tracks, sleepers, tees, valves, piping and all other work necessary to the installation of a combined steam and formaldehyde disinfecting system (except the supplying and installation of a vacuum pump); for the supply, installation and connection at outlets of a complete equipment of gas and electric lighting fixtures, consisting of brackets, clusters, ceiling lights, arc lamps and all other required work. And for the supply and complete installation and connection of cooking apparatus, fixtures and fittings; for providing all labor and materials, including vacuum air pumps, motors, separators, receivers, air filters, separate lines of piping, hose, renovators, fittings, fixtures, cases, equipment and all other work necessary for the installation and entire completion of a system of vacuum sweeping for the new Municipal Lodging House, situated approximately 400 ft. east of First Ave. and on the southerly side of 25th St., the Boro. of Manhattan.

A 6-story tenement house is to be built for the City & Suburban Homes Co., 287 Fourth Ave., on the premises No. 537 to 543 East 78th St. The parcel adjoins the company's model tenement holdings on what is known as the Ave. A estate. The building will have a frontage of 106.3 ft. and a depth of 83.4 ft., and will contain 15 small suites of apartments on the first floor and 17 suites on the other stories, some of which will be fitted with bath-rooms. There will be public shower baths and a playground in the middle of the cellar. The building is to cost $100,000. P. H. Ohm is Arch.

The following bids were received on Oct. 5 by C. B. J. Snyder, Supt., of School Bldgs., Dept. Education, for installing heating and ventilating apparatus in Public School No. 157, Boro. of Brooklyn: JAMES CURRAN MFG. CO., 512 East 36th St., $49,800 (awarded contract); Hopkins Jordan Co., $56,960; Blake & William, 211 West 21st St., $51,733; William C. Ormond, $51,766; E. Rutzler Co., 127 White St., $51,000; D. J. Rice, 5 East 42d St., $55,544; Frank Dobson, Inc., 519 East 83d St., $50,346; Raizler Heating Co., 1066 Broadway, $50,989.

The bids received on Oct. 5 by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, for installing heating and ventilating apparatus for addition and alterations in Public School No. 132, Boro. of Manhattan, were as follows: RAISLER HEATING CO., 1066 Broadway, $9,375 (awarded contract); James Curran Mfg. Co., 512 East 36th St., $9,400; E. Rutzler Co., 127 White St., $9,700; Daniel J. Rice, 5 East 42d St., $11,406; William J. Olvaney, 177 Christopher St., $10,518.

ALBANY, N. Y.—The Wareham Co., 83 State St., has purchased the old site of the State Normal College and has begun demolition and excavation for apartment houses, the aggregate cost of which will be about $350,000. There will be three or four of the houses and they will front on Willett St., extending back between 110 and 150 ft. They will be six stories high. The general material of construction will be Harvard brick, with white marble trimmings, the design being purely colonial. Each house will be equipped with an electric elevator and the interior hall decorations will be of white marble and tile, which also will be the finish of the baths. The rooms will be finished in quartered oak. A vacuum cleaning system will be installed in each house. Steam heat with hot water and electric lighting will be installed. William J. Obenaus, 119 State St., is Arch.

BRIDGETON, N. J.—Watson, Huckel & Co., Archs., 1211 Walnut St., Philadelphia, Pa., are drawing plans for the erection of a court-house in Bridgeton, N. J. It will be two stories and a basement in height and will measure 126 × 111 ft. The exterior will be finished in brick and Indiana limestone in colonial style. The plans call for two court-rooms and quarters for the county officers.

*WEEHAWKEN, N. J.—Bids are asked until 7 p. m., Nov. 17, by Herman Walker, 72 Hudson Ave., Guttenberg, N. J., Chn. Bldg. Com., North Hudson Hospital Association, for the erection; construction and completion of a brick hospital building on Bulls-ferry Road, in the Township of Weehawken, Hudson County. Hermann Horenburger, 422 East 159th St., New York, is Arch.

PATERSON, N. J.—Bids are asked by Henry Ridgway, Secy. Bd. of Education, 23 City Hall, until 8 p. m., Oct. 27, for the erection of Public School No. 24, at 19th Ave. and East 22d and East 23d Sts. The school is to be three stories, 130 × 168 ft., built of brick. William P. Fanning, Arch., Colt Bldg., prepared the plans. Cost, $140,000.

PHILADELPHIA, PA.—ARTHUR H. WILLIAMS' SON, 419 Locust St., has been awarded a contract for the erection of a 3-story brick and stone-trimmed parish house for the Protestant Episcopal Church of the Nativity, at Eleventh and Mount Vernon Sts. Cost, $40,000. George Nattress & Son are Archs., 12th and Walnut Sts.

Cyrus H. K. Curtis, publisher, will erect a 9-story building at Sixth and Walnut Sts., to cost about $1,500,000.

Stearn & Castor, Archs., Stephen Girard Bldg., have completed plans for improvements to the Muhr Bldg., at Broad and Cherry Sts., to cost $175,000, to fit it for the cathedral of the Philadelphia Consistory Scottish Rite Masons. Estimates will be taken at once.

PITTSBURG, PA.—O. M. Topp, Arch., Empire Bldg., Pittsburg, advises us that bids will be received about Oct. 17 for constructing a 4-story building, 100 × 110 ft., for the T. C. Jenkins Estate. The building will be erected at Penn Ave. and Fifth St. and will cost $85 000.

PITTSBURG, PA.—Bids are asked until Oct. 21 by Kiehnel & Elliott, Archs., 209 Ninth St., Pittsburg, for constructing the insane hospital to be built at Marshalsea. The building will cost about $100,000. It will be two and three stories high and will have a 300-ft. front. Among those on the committee are George W. Guthrie, Mayor, and J. P. Shaw, Dir. Charities Dept. Dr. S. L. Dixon is State Health Supt.

CANONSBURG, PA.—The contract for the passenger station for the Pittsburg, Cincinnati, Chicago & St. Louis Ry. Co. at Canonsburg, Pa., has been awarded to VESTOR, STEWART & ROSSEL, of Washington, Pa. It will cost about $50,000. The old building has been moved to another site and will be used for a freight station.

MERCER, PA.—On Oct. 3 the Mercer County Commissioners awarded the contract for the construction of the proposed court-house to W. W. LUYSTER, of Dayton, Ohio, for $324,100, this being the lowest bid. The heating contract went to the AMERICAN WARMING & VENTILATING CO., of Pittsburg, for $11,300; plumbing, J. W. BYERS, Mercer, $4,410; electric wiring, IRON CITY ENGINEERING CO., of Pittsburg.

MONONGAHELA, PA.—The School Board has decided to erect a school in the Third Ward at a cost of $52,000. Plans will be prepared at once.

HAGERSTOWN, MD.—Bids were received as follows Oct. 8 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Hagerstown, Md.: William P. Lipscomb & Co., Washington, $55,382; Boryer & Smith, Washington, $39,975; Benjamin F. Bennett & Co., Baltimore, $53,000; David Peoples, Betz Bldg., Philadelphia, Pa., $46,987; Pavarini & Wyne, Washington, $49,700; Henry E. Baton, Philadelphia, $54,000; Wilmarth Building Co., New York, $51,945; George A. Glenn & Co., Philadelphia, $49,500; Mark P. Wells, Philadelphia, $47,777; Charles McCaul Co., Philadelphia, $55,295; J. E. & A. L. Pennock, Philadelphia, $54,800; King Lumber Co., Charlottesville, Va., $49,440; W. H. Fissell & Co., New York, $56,970; W. A. Tiller, Keyser, W. Va., $54,497; Frank R. Haener, Noristown, Pa., $61,700; Ambrose B. Stannard, New York, $58,000; James G. Dock & Co., Philadelphia, $51,698; Thompson-Starrett Co., $51,000; Charles J. Cassidy Co., Inc., Washington, $59,816.

WASHINGTON, D. C.—The Evans Estate will erect a 9-story office building at 1416 New York Ave., to cost $266,000. The contract has been let to the GEORGE A. FULLER CO., Munsey Bldg., Washington. John O. Evans, 1424 New York Ave., is Agent for the Evans Estate; Frederick B. Pyle is Arch., 1003 F St.

NORFOLK, VA.—We are officially advised that Alvah H. Martin will erect a 4-story apartment house, 50 × 125 ft., in Berkley Ward. There will be two stories on first floor, and twelve 5 and 6-room housekeeping apartments on upper floors. Approximate cost, $45,000. Lee & Diehl, Seaboard Bank Bldg., Norfolk, are Archs. Plans are ready for estimates.

NORFOLK, VA.—The Y. M. C. A., L. Lankford, Pres., has accepted plans by Rossel Edward Mitchell, Norfolk, for the proposed association building, 60 × 124 ft. It will have four stories, basement, mezzanine floor and roof garden, will be of brick and stone construction; slow burning and will cost between $100,000 and $150,000.

WHEELING, W. VA.—The Board of Education has awarded contract to the W. W. WOOD CO., at $98,999, for building the proposed high school.

GREENWOOD, S. C.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, has awarded contract for the construction of a post-office at Greenwood, S. C., to FREDERICK MINSHALL, Abbeville, S. C., at $42,550.

SUMMERVILLE, GA.—Plans and bids will be received by T. J. Simmins, Chn. Bd., or E. N. Martin, Clerk, until Oct. 19 for a court-house.

*BRUNSWICK, GA.—Bids are asked until 3 p. m., Nov. 3, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for improvements to buildings, etc., at the U. S. quarantine station, Brunswick, Ga.

DALTON, GA.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, has awarded contract for the construction of a post-office at Dalton, Ga., to ALGERNON BLAIR, Montgomery, Ala., at $38,246.

BIRMINGHAM, ALA.—The Farley office building is to be erected on the corner of Third Ave. and 20th St., and work is to be commenced at once. The contract stipulates that it must be ready for occupancy by April 1, 1909. H. D. Breeding, Watts Bldg., is Arch., and the contract has been let to LISLE & DUNNING. J. G. Farley, of Anniston, owns this site and is investing in the construction of this building, which, when completed, will represent an investment of $275,000. James A. Going is acting as agent for Mr. Farley in the matter. It will front 50 ft. on 20th St. and 100 ft. on Third Ave.

AGRICULTURAL COLLEGE, MISS.—The building committee of the Mississippi Agricultural and Mechanical College has awarded the contract for a dormitory to W. T. CHRISTOPHER, Gadsden, Ala., at $62,648.

CAMBRIDGE, OHIO.—Bids are asked until noon, Oct. 29, by the Board of Education, for constructing a 2-story high school building, 80 × 134 ft. F. C. Hanna is Clerk; J. F. Orr, Central National Bank Bldg., is Arch.

ESCANABA, MICH.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post-office at Escanaba, Mich., to CARL J. LANGE and R. F. HOFFMAN, Appleton, Wis., at $51,000.

CHICAGO, ILL.—We are officially advised that the piling contract for constructing the Printers' Bldg., for James A. Patten, Evanston, has been let to WALSH & MASTERSON, 95 Clark St., Chicago. Other contracts will be let at once. The building will be eight stories high, 102 × 210 ft., of mill construction, and will cost $275,000. H. B. Wheelock, Schiller Bldg., is Arch.

*NEW ULM, MINN.—Bids are asked until 3 p. m., Nov. 18, by James Knox Taylor, Superv Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. post-office at New Ulm, Minn.

CROOKSTON, MINN.—Bids are asked until 3 p. m., Nov. 17, by James Knox Taylor, Superv. Arch., Treasury Dept., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. post-office at Crookston.

FERGUS FALLS, MINN.—We are officially advised that the State Board of Control, P. M. Ringdal, Chn., has let contract to JOHN LAURITZEN, of Fergus Falls, for the general construction of a 2-story pressed brick and cut stone addition to the State Insane Asylum at Fergus Falls, Minn. It will have steam heating, electric lighting and modern plumbing, and will be fireproof throughout. C. H. Johnston, Manhattan Bldg., St. Paul, is Arch. Cost, $65,000.

LAWRENCE, KAN.—We are officially advised that the Regents of the University of Kansas have let contract to H. EILENBERGER & CO., 153 La Salle St., Chicago, Ill. for the erection of a Mining Engineering building on the campus of the University at Lawrence; also for furnishing all labor and materials for the complete installation of a system of heating and plumbing and electric wiring in said Mining Engineering building. John F. Stanton, Capitol Bldg., Topeka, Kan., is State Arch.

GREAT FALLS, MONT.—The plans of W. R. Mowery, Arch., for the St. Thomas Orphans Home to be erected in this city have been approved and construction work will commence as soon as contracts can be let. The building will be brick with stone trimmings and will cost about $80,000.

ST. LOUIS, MO.—Bids were received on Oct. 9 by the Board of Education for the erection of the Carr School, at 15th and Carr Sts., which will be built around the Present Carr School so that the latter can be used until the new section of the Carr School is ready for occupancy. The lowest bidder was Murch Bros. Construction Co., Odd Fellows' Bldg., $113,400. The other bids were Hoosac Building & Construction Co., $113,985; Hiram Lloyd, $117,866; E. C. Gerhard, $117,777; J. W. Wilson & Son, $119,000; Hartman Building & Construction Co., $119,000; Wall Bros. $119,924; Merrill Construction Co., $121,444; E. A. Steininger, $122,483; S. L. Jones, $122,500; George L. Gerber, $124,936; Pelligre[illegible] Construction Co., $135,000; Charles O. A[illegible]ruik, $142,000. Gillick Bros., $119,988; Fr[illegible]ecke, $120,450.

Barnett, Haynes & Barnet[illegible]rchs., Frisco Bldg., have let general con[illegible] to N. PELLIGREEN, 816 Pine St., [illegible] the Visitation Parish, R[illegible] Church for Pastor. Cost, $50,000.

LITTLE ROCK, ARK.—[illegible] Knox Taylor, Superv. Arch., Treas[illegible]ept., Washington, has awarded to [illegible] BARDON Fort Worth, Tex., contract [illegible] construction of an extension to the [illegible] Rock postoffice, at $108,365.

COLLEGE STATION, TE[illegible]ids will be received by R. T. Milner[illegible] Agricultural and Mechanical Colleg[illegible] until 9 a. m. Oct. 20, for the erection a[illegible] completion of an Engineering building a[illegible] Glesecke is College Arch.

PORT ARTHUR, TEX.—T[illegible] Port Arthur Hotel Co., Jan Van Tyen, P[illegible] has awarded contract to H. G. APPLE[illegible] & SON, Beaumont, Tex., for erection [illegible] hotel, three stories, concrete, of ordin[illegible] construction with lighting of city electr[illegible] plant. Estimated cost, $90,000. C. A. [illegible]son, of Port Arthur, is Arch.

OKLAHOMA CITY, OKLA.—[illegible] the city will erect a school building with three stories and basement, fireproof, to accommodate 1,500 students. It will have a frontage of 200 ft., extending 300 ft. in the rear.

L. F. LEE has been awarded the contract for the construction of the W. J. Pettee Co. building at 121-23 West Main St., at $45,000.

OKLAHOMA CITY, OKLA.—Plans for the erection of a flat building for F. B. Zeeler, drawn by A. J. Williams, Old P. O. Bldg., Arch., have been approved and the contract for the construction work will be let at once. Brick and terra cotta will be used in the construction of this building. The building will be located on the corner of Eighth St. and Broadway and will cost in the neighborhood of $75,000. The structure will have a frontage of 125 ft. on Broadway and 140 ft. on Eighth St. and will contain 18 separate apartments containing seven rooms each, or a total of 105 rooms. Three towers, two on Broadway and one on Eighth St. will be built. The plans include a rathskeller on the Broadway side.

Huckins Bros., Oklahoma City, will reconstruct their hotel here, lately destroyed by fire. A building costing $100,000 and containing 300 rooms will be erected. Clarence King, Shreveport, La., is Arch. Work will be started about Dec. 1. Leon Huckins, Shreveport, La.; Paul Huckins, Texarkana, Ark.-Tex.; Joseph Huckins, Oklahoma City.

DENVER, COLO.—J. A. Ferguson, Century Bldg., has taken out a permit for the erection of a 6-story office building in Stout St., adjoining the Century Building, between 17th and 18th Sts. The building is to cost $100,000. It will be constructed of reinforced concrete and steel and contain 120 office rooms. W. E. Fisher & Bros., Railway Exchange Bldg., Denver, are Archs. Work is to be started immediately.

A permit was also issued to Mrs. John Pierce for a 4-story hotel in California St., between 13th and 14th Sts. This is to be a fireproof building to cost $40,000, and work has already started. Marean & Norton, 1634 Broadway, Denver, are Archs.

DENVER, COLO.—We are officially advised that the JONES-WHEELER-CRANMER ENGINEERING CO, Ernest & Cranmer Bldg., Denver, has secured the contract for the reinforced concrete work on the Ferguson Building at Denver. It will be erected upon the Turner mushroom system for reinforced concrete and will be constructed of fireproof materials.

TACOMA, WASH.—Bids are asked by C. B. Hopkins, U. S. Marshal, Tacoma, until noon, Oct. 31, for the steel work necessary for the erection and completion of the cells in the new wing at the U. S. penitentiary, McNeil Island, Wash. Proctor & Farrell, National Bank of Commerce Bldg., Tacoma, are Archs.

We are officially advised that J. E. BONNELL has secured general contract for constructing an 8-story furniture repository and show rooms, 120 × 150 ft., for F. A. Harmon, to cost $120,000, complete. Bids will be received at once for heating, elevators, sprinklers and electric conduit wiring. Darmer & Cutting, 1111 South C St., are Archs.

SAN FRANCISCO, CAL.—The contract for the construction of the Y. M. C. A. building has been awarded to the CHARLES J. LINDGREN CO., Humboldt Bank Bldg., and work will begin on the site at the corner of Golden Gate Ave. and Leavenworth St. at once. It will be completed in 18 months. McDougall Bros., 755 Devisadero St., are Archs. for the building, which will be nine stories high, steel frame, Class A. It will contain 140 sleeping rooms, with baths and telephones. On the sixth floor will be two gymnasiums, one 60 × 100 ft. for men, the other for boys, 60 × 45 ft.

A 6-story building with an ornamental front in stone will be erected on the south side of Market St., opposite Grant Ave., on the site of the Spreckels market. The plans of D. H. Burnham & Co., Archs., Railway Exchange Bldg., Chicago, present a building with a facade in the early Italian Renaissance, the stories being divided into distinct courses with effective pilasters supporting the courses between and the cornice. The upper floors will be arranged for offices, and the ground floor for one store. The cost is estimated at $150,000. Construction will begin Dec. 1, and end in five months.

SAN FRANCISCO, CAL.—Balfour, Guthrie & Co., 320 Sansome St., have applied for a permit to erect a 2-story brick, stone and concrete building on the north side of California St., 45 ft. east of Sansome St. The cost of the building is estimated at $100,000.

YARMOUTH, N. S.—Bids are asked until Oct. 27 by the Directors of the Y. M. C. A. for constructing a Y. M. C. A. building on Cliff St. J. C. Robbins, Yarmouth, is interested.

PORT ARTHUR, ONT.—T. A. Hastings, of the Department of Public Works, Ottawa, Ont., is arranging for the erection of an armory to cost $100,000.

WINNIPEG, MAN.—The contract for two freight sheds 50 × 40 ft. and 400 × 60 ft. for the Grand Trunk Pacific Ry. and Canadian Northern Ry. companies, has been awarded to J. H. TREMBLAY & CO., Winnipeg, Man.

WATER SUPPLY—IRRIGATION.

(denotes that this work is advertised in Engineering News.)*

OLD ORCHARD, ME.—The Biddeford & Saco Water Co. have awarded the contract to F. H. MARSHALL, of South Portland, Me., for laying about 15,000 ft. of c.-i. water pipe and constructing a foundation for the Standpipe at Old Orchard.

WINCHENDON, MASS.—The citizens have voted to authorize the Board of Water Commissioners to purchase an additional pump for the pumping station.

BROCKTON, MASS.—The Committee on Water on Sept. 25 decided to purchase a Holly pumping engine for the Silver Lake water plant as an auxiliary pump. Cost, $36,500.

DUNKIRK, N. Y.—The Water Board has awarded the contract to the ALLIS-CHALMERS CO., of Milwaukee, Wis., for a 500-KW. curbo-generator at $14,997.

*MARCELLUS, N. Y.—We are officially advised that bids were opened on Sept. 30 by the Board of Trustees for the construction of a water-works system. Contracts were awarded as follows: To EDSON BROS., of Phelps, N. Y., general construction, including 500 cu. yds. earth excavation, 35 cts.; 40 cu. yds. concrete masonry, $6.85; 50 cu. yds. slope paving, $1.50; 44 lin. ft. vitrified pipe overflow, $1.45; 2,340 lin. ft. trenching and laying 4-in. pipe, 18 cts.; 17,650 lin. ft. 6-in., 20 cts.; 4,200 lin. ft. 8-in., 26 cts.; 60 lin. ft. 10-in., 30 cts.; delivering pipe and specials, 455 tons, per ton, 40 cts.; setting 31 hydrants, each, $2; setting 18 stop valves, each, $1; 300 cu. yds. rock excavation, $1; total, $9,708. To CHARLES MILLER & SON CO., of Utica, N. Y., for 440 tons c.-i. pipe, per ton, $23.15, and 11,000 lbs. special castings, per lb., 2½ cts.; total, $10,461. To LUDLOW VALVE CO., of Troy, N. Y., for furnishing hydrants, valves and valve boxes, $974. Morrison & Farrington, Inc., Syracuse, N. Y., are Engrs.

BROOKLYN, N. Y.—Bids were received as follows on Oct. 7 by John H. O'Brien, Comr. Water Supply, Gas and Electricity, New York, for furnishing, constructing and erecting new pumping stations; also furnishing, delivering and erecting new pumping plants, complete, at Smith's Pond, Clear Stream and Valley Stream, Long Island, Borough of Brooklyn: Pumping stations: Kelley & Kelley, 45 East 42d St., $8,975; Garlitt Manning Co., $6,550; James McArthur, 22 Ormonde Place, Brooklyn, $8,879; McHarg-Barton Co., 299 Broadway, New York, $86,743; Madison Building Co., $9,000; W. L. & F. H. O'Shea, $8,920; C. M. Parks, $8,460. Pumping plants: C. H. Peckworth, 415 Hudson St., New York, $25,213; McHarg-Barton Co., 299 Broadway, $21,000; H. A. Worthington, 123 Liberty St., New York, $54,360; J. C. MacQuarrie, $45,400; D'Olier Eng. Co., Philadelphia, Pa., $53,878.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Oct. 28, by John H. O'Brien, Comr. Water Supply, Gas and Electricity, for extending and improving the high pressure fire service system in Coney Island, Borough of Brooklyn; for furnishing, delivering and installing a draining apparatus on fire hydrants in the Borough of Brooklyn; for furnishing and delivering well driving machines for sinking shallow wells.

*VERONA, N. J.—The Verona Borough Council awarded contracts on Oct. 2 for the water supply system as follows: Excavating and laying mains, PUGLIA & PALMER CO., of Paterson, N. J., $15,749; pipe and fittings, U. S. CAST-IRON PIPE & FOUNDRY CO., 71 Broadway, New York, $25,251; hydrant and boxes, EDDY HYDRANT CO., Waterford, N. Y., $2,247; valves and valve boxes, the FAIRBANKS CO., $2,270.

BRANCHVILLE, N. J.—The Mayor and Borough Council have passed a resolution, subject to a vote of the citizens, providing for a water supply system. Estimated cost, about $30,000.

FREEPORT, PA.—The GREER FILTER CO., Hartje Bldg., Pittsburg, Pa., has been awarded the contract for constructing a filter plant for the Freeport Water Co.

MILLVALE, PA.—Council has authorized the purchase of a new pump for the water-works, to cost $7,625, and the Property Committee was authorized to advertise for bids for the construction of an 80-ft. reinforced concrete smokestack for the water-works. The stack will be 14 ins. in thickness at the base and four inches in thickness at the top.

*WILMINGTON, DEL.—Bids will be received by the Board of Water Commissioners at the office of the Water Department, Sixth and King Sts., Wilmington, until 10.30 a. m., Nov. 23, for the construction of a covered, slow sand filtration plant, together with filter water reservoir, filter sand washing apparatus and other appurtenances; the kind and the amount of work to be done or furnished under said proposals to be according to plans and specifications which may be seen in detail at the office of the Chief Engineer of the Water Department, Sixth and King Sts. John A. Kienle is Ch. Engr.

BALTIMORE, MD.—Daniel B. Banks, the engineer employed by the Fire Board to construct the high-pressure pipe-line system in the business section, submitted plans on Sept. 30 for the pumping station to be erected in the middle of Centre Market Space, near Pratt St. His recommendation was indorsed by the Board. According to the plans the structure will be a 1-story building, of fireproof construction, with a frontage of 44 ft. and a depth of 200 ft. Driveways 40 ft. wide will be constructed on each side of the building, where the pumps will be installed to force the water through the pipe-line laterals, so that a pressure of 200 to 300 lbs. per square each will be obtained at the flush hydrants.

WESTMINSTER, MD.—The Consolidated Utilities Co. of Westminster has been organized with $150,000 capital stock by consolidation of the Westminster Gaslight Co., Carroll County Electric Light & Power Co., Westminster Water Co. and Citizens' Water & Power Co. Dr. James H. Billingslea is Pres.; George M. Parke, Vice-Pres.; W. Carroll Shunk is Secy-Treas.

WASHINGTON, D. C.—W. F. Macfarland, Comr. District of Columbia, has recommended the special appropriation of $314,000 for the extension and enlargement of water mains, as follows: 30-in. main from Kentucky and Potomac Aves. to Twining City, $42,000; 20-in. main from Twining City to Congress Heights, $67,000; 20-in. main from Twining City to Benning, $70,000; 20-in. main from Reno reservoir to Pinehurst, $53,000; 36-in. main from pumping station to Brookland, D. C., $74,000; 12-in. main to extend fire protection to Reform School, $8,000.

MOORESVILLE, N. C.—The city has voted $25,000 of bonds for the construction of water-works and improvement of streets.

MARION, N. C.—The city has voted a bond issue of $20,000 for a gravity system of water supply requiring 6¼ miles of 16-in. piping, and a daily capacity of 550,000 gallons. J. B. Rider, Marion, Engr.-in-Charge.

MILLEN, GA.—See under Light and Power Plants.

TOLEDO, OHIO.—Bids will be called for by the Board of Public Service about Nov. 1 for the completion of the filtration plant. Estimated cost about $25,000. Contracts for the pumping engines have been let.

CALIFORNIA, OHIO.—Bids were opened on Sept. 25 by the Commissioners of Water Works for furnishing and delivering lime for the city's filtration plant at California. The contract was awarded to the MOORE-CONEY CO., at $7,260.

The AMERICAN STEEL & WIRE CO., Chicago, Ill., secured the contract for furnishing sulphate of iron, at $21,600.

GIRARD, OHIO.—The citizens on Sept. 29 voted to grant a franchise to R. H. Fothergill, of Youngstown, Ohio, and others for the construction of water-works here.

COLUMBUS, OHIO.—We are officially advised that S. S. Wyer, Consulting Engr., Harrison Bldg., Columbus, has been appointed by the National Fire Equipment Co. to prepare plans and specifications for a complete water-works and electrical lighting system for one of the Columbus suburban towns. Gas engines, power fire pumps, power deep well pumps, electric generators, switchboards, arc lamps, water mains, valves and fire hydrants, elevated tank and fire hose required, excavating for water mains, laying pipe, stringing wires and installing lamps and erection of pump-house will also be let by contract.

DAYTON, OHIO.—Bids are asked until noon, Oct. 19, by William Budroe, Clk. Bd. Pub. Ser., for constructing and installing a pumping station and appurtenances, including all labor and materials required for the entire completion of the pumping pit and building all excavation, pumping and necessary filling, the installation of motors and all other electrical apparatus, pumps, automatic starting and stopping devices, oiling system, all the necessary foundations and beds, shafting, struts, supports, all piping, sewering lists, manholes, valves, ladder, stoves, nonfreezing lavatory fixtures, properly bented traps, and connected with the nearest sanitary sewer and water mains in conformity with the city regulations, the removal of the 4-ft. valves in the levee opposite Earl Ave., sealing old sewer with a 3-ft. concrete wall, moving and setting valve in a new pump pit and the installation of a hand-car traveling crane of 3-ton capacity.

EAST LIVERPOOL, OHIO.—Bids will be received by the Board of Public Service until Oct. 21 for furnishing the necessary labor and material for laying a 6-in. standard water main in Sixth St., from Jefferson St. to Monroe St., Monroe to Fourth St., etc.

NEWCASTLE, IND.—The contract for a 700,000-gallon reservoir station at the municipal water station, to be used as a reserve in case of fire, has been awarded by the Council to CHARLES W. MINNICK, of Newcastle, at $3,976.

WOLCOTTVILLE, IND.—Bids were opened, we are officially advised, by the Board of Trustees on Sept. 25 for the construction of water-works and the following contracts were awarded: For pipe line, to the OLDS CONSTRUCTION CO., of Fort Wayne, Ind., at $3,264; for station equipment, to the NATIONAL CO., of South Bend, Ind., at $4,500.

WYANDOTTE, MICH.—The Board of Public Works and Council on Oct. 1 approved the plans of R. Winthrop Pratt, of Columbus, Ohio, for a mechanical filtration plant for the purification of the water supply. Estimated cost, about $25,000.

SUTTONS BAY, MICH.—The contract for constructing a system of water-works here has been awarded to HERBERT JOYNT, Elk Rapids, Mich., at $4,988. Archie W. Gunn is Village Clk.

EAST LANSING, MICH.—The citizens on Sept. 29 voted to issue $10,000 of bonds for constructing water, sewer and drainage systems here.

*MUSKEGON, MICH.—Bids are asked until noon, Oct. 19, by Benjamin H. Tellman, City Recdr., for a vertical triple-expansion crank and fly-wheel pumping engine of the semi-self contained type, with 6,000,000 gallons capacity in 24 hrs., as per specifications on file in the Recorder's office.

CHICAGO, ILL.—Bids will be received until Oct. 24 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and constructing the pump pit, suction well and foundations for building for a pumping station engine house at 104th St. and Stewart Ave., known as Redlands Pumping Station, including excavation, pile driving, reinforced concrete work and structural steel.

WILWAUKEE, WIS.—Bids were opened on Oct. 2 by the Commissioners of Public Works, Chas. J. Poetsch, Chn., for furnishing and erecting for use at the North Point Pumping Station a 12,000,000-gallon pumping engine. The contract was awarded to the ALLIS-CHALMERS CO., Milwaukee, at $67,000.

MENDOTA, WIS.—Bids will be received by M. J. Tappins, Secy. of the State Board of Control, until Nov. 3 for enlarging the steel tank at the State Hospital, Mendota. Plans and specifications and blank proposals may be had from W. G. Kirchoffer, Engr., Madison, Wis.

EAST GRAND FORKS, MINN.—Bids will be received until 3 p. m., Oct. 19, by the City Council for constructing water-works, consisting of c.-i. pipe and special castings, fire hydrants, gate-valves and boxes, pipe laying, pump pit and intake, a 100,000-gallon steel tower and tank. Bids may be submitted separately or as a whole for the work. Loweth & Wolff are Engrs., St. Paul, Minn. C. P. Zimmerman is City Clk.

SHAKOPEE, MINN.—We are officially advised that the contract was awarded on Oct. 5 by Common Council for furnishing material and constructing water-works, consisting of c.-i. pipe and special castings, fire hydrant and valves, and a 100,000-gallon steel tower and tank to W. C. FRAZER, of Rochester, Minn., at $5,150. Loweth & Wolff are Engrs., St. Paul, Minn.

KIRWIN, KAN.—Bids will be received until Oct. 17 by the City Council for furnishing material and constructing water-works, to consist of 4,400 ft. 6-in. and 12,900 ft. 4-in. c.-i. pipe, 22 double discharge fire hydrants, 5,000 ft. 2-in. galvanized pipe, 100,000-gallon steel tank, 20-HP. combined pump and gasoline engine. J. A. Stagg is Mayor.

LINCOLN, NEB.—Bids will be received until noon, Oct. 17, by Thomas H. Pratt, City Clk., for furnishing 175 tons of 20-in. c.-i. pipe, Class D, and 150 tons 6-in. and 50 tons 4-in. c.-i. water pipe, Class C.

PLATTE, S. DAK.—Bids were opened on Sept. 18 by W. F. Van Der Voort, City Audr., for constructing a steel water tower with steel tank of 60,000 U. S. gallons capacity and 11,424 ft. of 4, 6 and 8-in. water mains laid. The contract was awarded to the MORAVA CONSTRUCTION CO., 85th St. and Stewart Ave., Chicago, Ill., at $15,398. J. L. Nelson, of Mitchell, S. Dak., is Engr. List of bidders noted on Sept. 24.

KANSAS CITY, MO.—Work will probably begin at once on the construction of a new water storage basin of 50,000,000 gallons capacity at the Quindaro pumping station. Estimated cost, about $175,000. W. G. Goodwin is Ch. Engr. Water Dept.

HOLLY, COLO.—Bids were opened on Sept. 23 for the construction of water-works. The lowest bids submitted follow: General construction, Kewanee Sanitary Sewer Co., Kewanee, Ill., $7,035, with concrete powerhouse; $7,235 with brick power-house; hydrants and valves, Chapman Valve Co., Chicago, Ill., $1,000; tower and tank, W. W. Cook & Son, Junction City, Kan., $4,600; and c.-i. pipe, Colorado Fuel & Iron Co., Pueblo, Colo., $8,385. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Engrs.

KENNEWICK, WASH.—See item under Light and Power Plants.

LOS ANGELES, CAL.—Bids will be received by the Secretary of the Board of Water Commissioners, 440 South Hill St., until Nov. 2, for furnishing and delivering approximately 2,740 tons of standard bell and spigot c.-i. water pipe, ranging in size from 4-in. to 20-in.

SEWERAGE.

(denotes that this work is advertised in Engineering News.)*

SALEM, MASS.—The Common Council has authorized the Sewerage Commission to expend $10,000 for the construction of a sewer in Essex St., from Liberty to Webb Sts.

BROCKTON, MASS.—The Sewer Commissioners have awarded the contract for furnishing the city with 3,000 ft. of c.-i. soil pipe to J. T. CORCORAN, the lowest of seven bidders. The pipe is to be delivered by Oct. 15. The bids were as follows: J. T. Corcoran, 16 cts. a ft.; V. R. Donovan & Co., 16.75 cts.; John J. Powers, 16.76 cts.; P. & H. Gilligan Co., 17 cts.; Dahlborg & Anderson, 17 cts.; Kinney Heating & Supply Co., 17 cts.; J. E. Carr & Sons, 17 cts.

WHITESTONE (L. I.), N. Y.—Plans to connect the sewerage system of Malba, at Whitestone, L. I., have been submitted to the Queens Borough engineers and approved. The trunk sewer extends through 21st St. of the Malba tract. Water mains have been connected and the current for electric lighting purposes has been secured. Lawrence Gresser is Boro. Pres.

NEW YORK, N. Y.—Bids are asked until 11 a. m., Oct. 27, by Lawrence Gresser, Pres. Boro. of Queens, for constructing sewers and appurtenances in various streets, catch-basins and temporary catch-basins.

ELIZABETH, N. J.—Bids will be received by N. K. Thompson, Street Comr., until Nov. 2, for the construction of an intercepting sewer. W. H. Luster, Jr., is City Surv.

WEST NEW YORK, N. J.—Bids are asked by the Town Council until 8 p. m., Oct. 15, for the construction of a sewer in Twelfth St., from Bergenline Ave. to a point about Madison St. James L. Wolfe is Town Clk.

HADDONFIELD, N. J.—The Borough Council on Sept. 29 awarded the contract to BELL BROS., of Haddonfield, for the construction of about 1,000 ft. of lateral sewers in Linden, Trueman and Haddon Aves., at 55 cts. per ft. and 50 cts. extra for all ties where specified; flush tanks, $60 each; three manholes at $70 each, and convert one manhole into a flush tank, as required, at $10. Allen Clymer is Boro. Clk.

CHESWICK, PA.—Bids are asked until noon, Oct. 20, by the Borough for furnishing all material and all labor necessary to construct and fully complete a sewage disposal plant and appurtenances, in accordance with plans No. 3072 and No. 3073 and specifications on file with the Borough Engr. at Cheswick, and also at the office of Chapin & Knowles, Frick Bldg., Pittsburg, Pa.

WILKES-BARRE, PA.—Plans and specifications are on file at the office of Engineering News, New York, for the construction of about one mile of circular brick sewer. Bids are asked until Oct. 26.

LEMOYNE, PA.—The boroughs of Wermleysburg, Lemoyne and Camp Hill have organized to construct a sewage disposal system in accordance with the recommendation of the State Health Commissioner.

PITTSBURG, PA.—Bids are asked until 2 p. m., Oct. 16, by F. P. Booth, County Controller, Pittsburg, for the construction of a sewer at the Soldiers' Memorial.

ALTOONA, PA.—The Board of Public Works on Oct. 2 awarded the contract for the construction of five sewers to J. L. WILSON.

WASHINGTON, D. C.—Bids are asked until noon, Nov. 2, by the Commissioners of the District of Columbia for constructing the Congress Heights trunk sewer.

WASHINGTON, D. C.—The W. F. BRENIZER CO., of Washington, has secured the contract for constructing portions of Rock Creek and B St. intercepting sewers, bids opened on Sept. 28, at $14,225. Noted on Oct. 1.

WINSTON-SALEM, N. C.—The city has awarded the contract to the CRAWFORD PLUMBING & MILL SUPPLY CO., of Winston-Salem, at $11,430 for laying about three miles of sanitary sewer pipes. J. N. Ambler is City Engr.

FLORENCE, ALA.—Bids are asked by the city until Oct. 19 for the construction of two separate extensions of the sanitary sewer system. J. B. White is City Clk.

TOLEDO, OHIO.—M. LEWANDOWSKI on Sept. 30 secured the contract for constructing sewers in Weber St., at $5,818.

CINCINNATI, OHIO.—Bids will be received until Oct. 19 by the Board of Public Service, John J. Wenner, Clk., for furnishing material and constructing drains and sewers in portions of Fischer, Collins and Herron Aves., and Powers and other streets.

GALION, OHIO.—Bids will be received by the Board of Public Service, John T. Shea, Clk., until Oct. 19 for constructing about three miles of trunk line sewer.

*WYOMING, OHIO.—Bids are asked until noon, Nov. 4, by W. A. Clark, Village Clk., for the construction of a sewage disposal plant, and about 22,569 ft. of sanitary sewers, with the necessary appurtenances. Size of sewers ranges from 8 ins. to 18 ins. in diameter, all to be of double strength vitrified pipe. Plans and specifications can be seen and bidding blanks obtained at the office of the Village Clerk or from the Riggs & Sherman Co., Engrs., Toledo, Ohio.

ZANESVILLE, OHIO.—Bids are asked until noon, Oct. 19, by the Board of Public Service for the construction of a storm and sanitary sewer in Granite Alley and sanitary sewer pipe in Gilbert Alley. J. T. Hahn is Clk. Bd.

*HARTWELL, OHIO.—Bids will be received by the Council of the Village until noon, Nov. 16, for furnishing the necessary labor and materials for the construction of sewers and for the construction of sewage disposal works, according to the plans and specifications on file in the office of Village Clerk, and with C. L. Swain, No. 57 Atlas Bank Bldg., Cincinnati, Ohio, and with Riggs & Sherman Co., 613 The Naaby, Toledo, Ohio. Frank J. Spinning is Clk.

MISHAWAKA, IND.—The City Council will soon ask for bids for the construction of a sanitary sewer in Elm St.

EVANSVILLE, IND.—JOHN L. NEWMAN was awarded the contract on Oct. 3 by the Board of Public Service for constructing a sewer in the alley between Edgar and Oakley Sts., from Franklin St. to 75 ft. of Illinois St.

INDIANAPOLIS, IND.—Charles A. Brown, Asst. City Engr.-in-Charge of sewers, is preparing plans for a new sanitary sewer system for the East Market house.

Plans were begun on Oct. 4 for a sanitary and storm sewer system for the Irvington Park addition, which lies between Emerson Ave. and Wallace St., from New York to Michigan Sts. This sewer will run in Riley Rve., from Washington St. to the first alley north of North St., with branches in the alleys east of Bancroft St., Riley Ave., De Quincy and Wallace Sts., and also in the alley north of East New York St., from Emerson Ave. to Wallace St.

EAST LANSING, MICH.—See item under Water Supply—Irrigation.

LANSING, MICH.—FITZPATRICK, FISHER & NOYCE, secured the contract on Sept. 28 for constructing 1,150 ft. 26 × 39-in. and 1,350 ft. 24 × 36-in. brick sewer, and 500 ft. D. S. pipe sewer, at $8,300.

DETROIT, MICH.—The Department of Public Works has awarded the contract to GEORGE R. COOKE for the construction of the Campbell Ave. public sewer and outlet. J. J. Haarer is Comr.

GRAND RAPIDS, MICH.—Plans are being completed by L. W. Anderson, City Engr., for the pumps and motors for the new sewage pumping station.

ISHPEMING, MICH.—The Board of Public Works has awarded contracts to CHARLES JOHNSON and PETER MUNSON for constructing a sewer in the Sixth Ward. P. H. Devine is Supt. Pub. Wks.

OBLONG, ILL.—I. W. OSBORNE & CO., Mattoon, Ill., were awarded the contract on Sept. 28 for the construction of the sewer system here, about 1½ miles long, at $5,537.

DECATUR, ILL.—Bids are asked until 2 p. m., Oct. 17, by the Board of Local Im-

provements for the construction of a tile pipe sewer. A. B. Alexander is Engr.

VENICE, ILL.—A sewerage system is to be constructed jointly by the cities of Madison and Venice. Total cost, $105,000.

APPLETON, WIS.—We are officially advised that F. E. KAMINSKI, of Berlin, Wis., has been awarded the contract by E. L. Williams, City Clk., for constructing 1,000 ft. of 36-in. pipe sewer. Bids were opened on Oct. 6.

CRESCO, IOWA.—The Sewer Committee has awarded the contract to OLIVER G. KRINGLE, Elkader, Iowa, for constructing a sewer, aggregating 2,875 ft. in length, with six manholes and one flush tank. H. G. Addie is Chn.

LAWRENCE, KAN.—We are officially advised that GRAEBER BROS., of Lawrence, were awarded the contract on Oct. 5 by the city for the construction of a lateral sewer in the alley between Illinois and Alabama Sts., from Berkeley St. South, 350 ft. of 8-in. pipe; for lateral sewer in alley between Ohio and Louisiana Sts., from Ontario St. south to main sewer in Bews' Ave., 600 ft. of 8-in. pipe, one flush tank, and for lateral sewer in alley between Indiana and Louisiana Sts., from main sewer in Penn St., south., 350 ft. with 8-in. pipe, at 51 cts. per ft.

P. A. JOHNSON & CO., of Kansas City, Kan., were awarded the contract for the construction of a main sanitary sewer in the east and southeast portions of Lawrence, 6,000 ft. or more of 12-in. vitrified sewer pipe and four or more manholes and a combined storm-water and sanitary sewer in Maryland St., in North Lawrence, about 1,500 ft. more or less of 15-in. vitrified sewer pipe and two manholes, at 75 cts. and 1.63 per ft.

DAVID CITY, NEB.—The City Council on Oct. 1 awarded to LANNA & CO., of Harlan, Iowa, the contract for the construction of sewers in sewer districts Nos. 1, 2 and 3, at $11,959.

MONTICELLO, ARK.—We are officially advised that Walter G. Kirkpatrick, of Jackson Miss., has been selected to make surveys and prepare plans for a system of house sewers, about seven miles in length. Patrick Henry is Mayor.

FORT SMITH, ARK.—The Sewer Commissioners have relet the contract for the sanitary sewer, calling for 42 miles of underground water drainage, formerly held by Granne & Co., to the COONEY CONSTRUCTION CO., of St. Louis, Mo.

PONCA CITY, OKLA.—The contract for sewer districts Nos. 2, 4 and 5, bids opened on Sept. 22, has been awarded to the S. & S. CONTRACTING CO., Massachusetts Bldg., Kansas City, Mo., at $11,151. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Engrs.

CHICKASHA, OKLA.—The City Council let the contract on Oct. 3 for the construction of storm sewers here to T. W. ROBERTS, of Independence, Mo., at $18,122. Concrete will be used.

SPOKANE, WASH.—The Board of Public Works has awarded the contract for the construction of the First Ward trunk sewer, District No. 3, bids opened on Sept. 22, to J. A. CLARK, at $49,000, the lowest bid received on the second call for competitive bids for this sewer. Engineer's estimate, $57,023. List of bidders noted on Oct. 8.

STREETS AND ROADS.

(denotes that this work is advertised in Engineering News.)*

BEVERLY, MASS.—SIMPSON BROS. CORPORATION, 166 Devonshire St., Boston, Mass., have been awarded the contract by the Street Committee for repaving a portion of Cabot St. with Hassam pavement.

HARTFORD, CONN.—Bids for the construction of state road work will be received at the office of the State Highway Commissioner, until 2 p. m., Oct. 19, as follows: Town of Hartland, two sections, grading and grading-telford, aggregating 5,215 lin. ft., with two 15-in., three 12-in. and one 24-in. tile culverts; Town of Southbury, 2,300 lin. ft. macadam and macadam-telford on Oxford road; Town of Vernon, 1,767 lin. ft. macadam on Union St.; Town of Sharon, 1,825 lin. ft. gravel-telford road with one 15-in. and one 18-in. tile culverts; Town of Warren, four sections graded and graded-telford road, aggregating about 4,000 lin. ft.

HARTFORD, CONN.—The following contracts for construction of state roads, bids for which were opened at the office of the State Highway Commissioner, on Oct. 5, have been awarded: Town of Roxbury, 11,600 lin. ft. gravel and gravel-telford road, with retaining wall to the B. D. PIERCE, JR., CO., Bridgeport, Conn., at $1.43 per lin. ft. for gravel, $2.03 for gravel-telford and $4.75 per cu. yd. for retaining wall. Other bidders were: O. T. Benedict, Pittsfield, Mass., $1.79, $2.29, $6; Lane Construction Co., Meriden, Conn., $1.54, $1.99, $6; Pierson Engineering & Construction Co., Bristol, Conn., $1.85, $2.45, $5.50. Six 15-in., three 18-in., one 24-in., three 12-in. and two 20-in. tile culverts, required; City of Derby, 6,300 lin. ft. macadam and macadam-telford road, with rubble drain, to same, at $1.81 per lin. ft. for 16-ft. road, $2.04 per lin. ft., for 18-ft. road, $2.41 per lin. ft. for macadam-telford, 65 cts. per lin. ft. for rubble drain. Other bidders were, O. T. Benedict, $2.05, $2.30, $2.65, 80 cts.; Lane Construction Co., $1.98, $2.23, $2.56, 75 cts.; C. W. Blakeslee & Sons, New Haven, Conn., $2.06, $2.21, $2.67, 75 cts. One 20-in. tile culvert required. The following bids were also received, but contracts have not as yet been awarded: Town of Harwinton—2,000 lin. ft. grading and one 15-in. tile culvert: Pierson Engineering & Construction Co., $10,570 and 40 cts per lin. ft. for railing; Joseph Mascetti, Torrington, Conn., $10,800 and 19 cts. per lin. ft. for railing. Town of Columbia, four sections: First section, 8,300 lin. ft. grading with telford base: O. T. Benedict, $7,999 and 70 cts. per lin. ft. for telford; Ahern Bros., Putnam, Conn., $5,644 and $1.55; Amos Bridges Sons, Hazardville, $7,189 and 60 cts.; A. Vito, Thompson, $6,225 and 68 cts.; T. H. Gill Co., Boston, Mass., $7,450 and 60 cts.; one 12-in., two 20-in. and one 24-in. tile culvert required. Second section, 1,740 lin. ft. of gravel and two 24-in. tile culverts: O. T. Benedict, $3,741; Amos Bridge's Sons, $3,600; A. Vito, $3,445; T. H. Gill Co., $4,698. Third section, 575 lin. ft. gravel-telford: O. T. Benedict, $975; Amos Bridge's Sons, $1,070; A. Vito, $966; T. H. Gill Co., $1,140. Fourth section, 1,800 lin. ft. grading and telford: O. T. Benedict, $4,500 and 50 cts. per lin. ft. for telford; Amos Bridge's Sons, $3,750 and 60 cts.; A. Vito, $7,200 and 68 cts.; T. H. Gill Co., $5,430 and 50 cts.

HARTFORD, CONN.—The Court of Common Council has ordered the laying of curb and gutter stones on both sides of Norfolk St., both sides of Kent St. and Baltimore St.; also laying sewer in New Britain Ave. and Greenfield St.

NEW BRITAIN, CONN.—Hawkins St., Union St., High St., Camp St., and West Ellis St. are to be macadamized at an estimated cost of about $14,000. Property owners have been ordered to lay curbs and make sewer and gas connections before Nov. 1.

NEW YORK, N. Y.—Bids are asked by J. W. Stevenson, Comr. Bridges, until 2 p. m., Oct. 22, for furnishing and delivering treated wood blocks to the bridge over the Newtown Creek, from Manhattan Ave., in the Borough of Brooklyn, to Vernon Ave., in the Borough of Queens.

NEW YORK, N. Y.—Bids are asked until 11 a. m., Oct. 27, by Lawrence Gresser, Pres. Boro. of Queens, for regulating, grading, concrete curbing, laying bluestone and concrete sidewalks and crosswalks, recurbing, flagging, reflagging on various streets.

BROOKLYN, N. Y.—Bids are asked until 11 a. m., Oct. 28, by Bird S. Coler, Boro. Pres., for regulating and paving with asphalt pavement, Class B, on a concrete foundation, the roadways of various streets and avenues.

BROOKLYN, N. Y.—Bids are asked by Bird S. Coler, Boro. Pres., until 11 a. m., Oct. 20, for regulating and repaving with iron slag pavement on a concrete foundation, the roadways of various streets.

*ALBANY, N. Y.—Bids are asked by Frederick Skene, State Engr., until noon, Nov. 9, for the construction of 63 new public highways under the Good Roads law. The names of the road,s together with their location and length in miles are as follows: Roads Nos. 309, Post, Sec. 2, Ulster County, 6.48 miles; 321, Reservation Road—Varick, Seneca County, 4.31; 346, Sprakers—Rural Grove, Sec. 2, Montgomery County, 2.52; 347, Canajoharie—Sharon Springs, Sec. 2, Montgomery County, 2.94; 392, Oak Orchard, Sec. 1, Orleans County, 3.342; 412, Port Jervis—Sullivan Co. Line, Sec. 1, Orange County, 5.74; 413 Highland Mills—Monroe, Orange County, 3.27; 440, Philadelphia, Jefferson County, 5.40; 444, Riverside Drive, Broome County, 1.14; 463, Manheim Center—Salisbury, Herkimer County, 5.52; 464 Salisbury Center—Stratford, Herkimer County, 5.46; 480, Buffalo, Sec. 4, Monroe County, 3.02; 481, Despatch—Pittsford, Monroe County, .99; 489, Tully, Onondaga County, 4.44; 491, Hilton—Bartletts Corners, Monroe County, 1.010; 493, Mendon—Pittsford, Monroe County, 6.26; 504, Troy—Speigletown, Rensselaer County, 1.69; 536, Schodack Center—Nassau, Rensselaer County, 5.19; 543, Johnstown—Broadalbin, Sec. 2, Fulton County, 6.35; 547, Willets—East Williston—Westbury Pond, Nassau County, 6.43; 533, Fly, Onondaga County, 2.33; 554 Fabius, Onondaga County, 4.91.

Bids are also asked until Nov. 11, for the following: Roads Nos. 564, Rome: Augusta—Westmoreland, Oneida County, 5.02 miles; 571, Spring Ave., Troy—Poestenkill, Rensselaer County, 2.61; 585, Towners Corners—County Line, Putnam County, 3.93; 604, Troy—Schenectady, Sec. 3, Albany County, 3.88; 610, Mechanicville—Malta, Saratoga County, 7.42; 612 Pawling—Dover Town Line, Dutchess County, 2.92; 627, Wicopee—Beekman, Dutchess County, 8.10; 630, Troy and Schenectady, Sec. 4, Albany County, 2.24; 633, Geneva—Halls Corners, Ontario, 5.04; 636, Stanley—Geneva, Ontario, 3.16; 642, Angola—Evans Center, Angola—Brant, Erie County, 6.90; 644, Alden—Town Line, Sec. 2, Erie County, .73; 645, Orchard Park—Griffins Mills, Erie County, 4.64; 646, Indian Fields—Dormansville, Albany County, 4.12; 650, Hudson—Hollowville, Columbia County, 5.66; 652, Champlain—Perrys Mills, Clinton County, 3.25; 654, Oswego—Mexico, Sec. 2, Oswego County, 5.35; 663, Otselic—South Otselic, Sec. 2, Chenango County, 4.42; 681, Ithaca—Dryden, Sec. 1, Tompkins County, 5.23; 685, Stirling—Oswego, Cayuga County, 4.88; 690, Monsey—Egypt Corners, Rockland County, 4.25.

Bids are also asked until Nov. 13 for the following: Roads Nos. 708, Sidney—Unadilla, Otsego County 4.68 miles; 713, North Tonawanda—Shawnee, Niagara County, 5.13; 714, Dansville—Mt. Morris, Sec. 1, Livingston County, 5.37; 723, Whitehall—Fort Ann Town Line, Washington County, 4.77; 725, Grand Central Ave., Sec. 2, Chemung County, .90; 727, Chittenango—Oneida, Sec. 1, Madison County, 5.15; 734, Potsdam—Parishville, Sec. 1, St. Lawrence County, 5.12; 736, North Creek—County Line, Warren County, 4.12; 737, Cortland—Truxton Cuyler, Cortland County, 5.79; 747, Delhi—Bloomville, Delaware County, 5.91; 750, Clarence Center, Erie County, 5.95; 754, Bath—Savona, Steuben County, 1.46; 768, Ossining—Kitchewan, Westchester County, 5.86; 769, Amawalk—Woods Bridge, Westchester County, 4.21; 770, Golden Bridge—Turk Hill, Westchester County, 3.85; 784, Cooperstown—Three Mile Point, Otsego County, 3.12; 788, South Schenectady—Mariaville, Schenectady County, 7.32; 794, Huntington—Amityville, Suffolk County, 10.14; 795, Jeffersonville—Kenoza Lake—Fosterdale, Sullivan County, 6.20; 796, Greenville—Coxsackie, Sec. 1, Greene County, 4.62.

*BAYONNE, N. J.—We are officially advised that the receipt of bids which were to be opened on Oct. 6 for the improvement of Broadway, from First St. to the Morris Canal, by paving with either bitulithic or asphalt block pavement, approximately 73,800 sq. yds., has been postponed for legal reasons. New bids will be asked later. F. W. Dalrymple is City Engr.

PITTSTON, PA.—We are officially advised that McCONVILLE & FITZPATRICK, 135 South Main St., Pittston, have secured the contract for paving South Main, Spring, Kennedy, Charles, William and Church Sts., with Mack block, at $19,637, and for the Oak St. concrete culvert, at $2,800.

ROCKVILLE, MD.—JOHN McATEE, Clearfield, Pa., has been awarded the contract for the construction of the pike from Potomac to Conduit Road, a distance of 4½ miles, at $19,153.

ALEXANDRIA, VA.—The city, together with Alexandria County, the Washington Southern Ry. Co. and the Washington, Alexandria & Mount Vernon Electric Ry. Co. are planning to improve King St. Estimated cost $18,000.

MOORESVILLE, N. C.—The city has voted $25,000 of bonds for street improvements and water-works construction.

ORANGEBURG, S. C.—We are officially advised that bids will probably be asked about the middle of November for paving Russell St. with macadam. Edward Hawes, Jr., is City Engr.

*ATLANTA, GA.—We are officially advised that D. NICHOLS & SON, of Edgewood, Ga., were awarded the contract on Oct. 3 by the city for the construction of macadam roadways (20,000—25,000 sq. yds.) on Ponce de Leon Ave., Druid Hills, Atlanta, at $13,146. Thomas Meehan & Sons, Inc., Mt. Airy, Pa., bid, $34,730.

GADSDEN, ALA.—The city will lay cement sidewalks on Chestnut, Fourth, Fifth, Twelfth and other streets.

CATLETTSBURG, KY.—The city will construct sidewalks 4, 8 and 10 ft. wide on Franklin, Division, Front and other streets, of sawed stone or concrete. Hugh Chatfield is City Clk.

LOUISVILLE, KY.—Bids for constructing 31 sidewalks in various parts of the city will be received by the Board of Public Works until Oct. 31. The work is in small contracts, but will aggregate about $15,000.

LEXINGTON, KY.—Bids will be received by John Skain, Mayor, at this office until noon, Oct. 24, for the construction of South Ashland Ave., from East Main St. to East High St., with macadam, brick, bitulithic, wooden block or asphalt.

PLEASANT RIDGE, OHIO.—Bids will be received by W. C. Davis, Clk. Bd. of Council 2 p. m., Oct. 21, for the construction of an artificial stone sidewalk on the south side of Burgoyne Ave., a distance of 6,491 ft.

CINCINNATI, OHIO.—Bids will be received until Oct. 16 by the County Commissioners, Fred. Dreihs, Clk., for improving Rittenhouse Road, in Miami Township, according to Specifications No. 799.

TOLEDO, OHIO.—Bids will be received until Oct. 28 by the County Commissioners, Toledo, for furnishing material and repairing the Jerusalem stone road. D. T. Davies, Jr., is County Audr.

GUERNSEY, OHIO.—The contract for paving twelve streets was let to W. H. RINGWALD & SONS, of Chillicothe, Ohio, by the Board of Public Service on Sept. 25.

YOUNGSTOWN, OHIO.—Bids are asked by the Board of Public Service until noon, Oct. 20, for grading a portion of McHenry St. and paving a portion of High St. W. H. McMillan is Clk. Bd.

STEUBENVILLE, OHIO.—The contract for the construction of the State aid road at Wintersville, 2.11 miles of grading and .78 miles of macadam, was awarded on Oct. 6 by J. C. Wonders, State Highway Comr., to A. W. McDONALD, and JOHN L. MARTIN, at $8,759. This was the only bid received.

HAMILTON, OHIO.—The Board of Public Service on Oct. 6 opened bids for resurfacing High and South Third Sts. as follows: High St., Garver Contracting Co., $21,273, for California asphalt; Barber Asphalt Paving Co., 108 La Salle St., Chicago, Ill., for Trinidad, $25,821; Andrews Asphalt Paving Co., Bermudez, $22,760; Trinidad, $19,031. South Third to Ludlow St. and repairs from Ludlow to Wood Sts., Garver Contracting Co., California asphalt, $5,845, Trinidad, $6,415; Barber Asphalt Paving Co., Trinidad, $4,810; Andrews Asphalt Paving Co., Bermudez Lake, $5,650, Trinidad, $4,810 (not accompanied by a certificate).

BEDFORD, IND.—The Commissioners of Lawrence County have awarded McNEE DUNN, of Anderson, Ind., the contract for part of the construction of six miles of road in Marshall Township.

HUNTINGTON, IND.—Bids will be received by John W. Weaver, County Audr., until 10 a. m., Nov. 2, for the construction of a gravel road in Township 26, North.

CRAWFORDSVILLE, IND.—Bids will be received by the Commissioners of Montgomery County until 10 a. m., Nov. 7, for the construction of a gravel road in Ripley Township, known as the Elmore Road. Bennett B. Engle, is County Audr.

GREEN CASTLE, IND.—Bids will be received by the Commissioners of Putnam County until Oct. 31, for the construction of 5,339 ft. of gravel road in Washington Township.

Bids will be received by the Commissioners of Putnam County until 9 a. m., Nov. 2, for the construction of 8,889.8 ft. of macadamized road in Cloverdale Township; 5,594.5 ft. of macadamized road in Monroe Township; 1,700 ft. of macadamized road in Green Castle Township, and 11,913.7 ft. of macadamized road in Franklin Township. D. V. Moffitt is County Audr.

TIPTON, IND.—Bids w[illegible] the Commissioners of Tip[illegible] a. m., Nov. 2, for the con[illegible] lowing gravel roads: G[illegible] the Idlewine road, 10,550 gravel road known as the [illegible] f.t in length in Madison road known as the Ricke[illegible] length; gravel road know[illegible] road, 8,343 ft. in length, [illegible] ship; gravel road know[illegible] 7,898 ft. in length; the B[illegible] in length; the Dovenberg[illegible] length; the Tranbarger [illegible] length in Cicero Township [illegible] in Prairie Township, 5,290 [illegible] 5,453 ft. in length, respe[illegible] road in Liberty Township, [illegible] nine gravel roads in Wild[illegible] gregating 41,828 ft. in len[illegible] is County Audr.

ARCADIA, IND.—The [illegible] Hamilton County will soon [illegible] the construction of the [illegible] road including Jackson St. [illegible] timated cost, $20,000.

SPRINGFIELD, ILL.—T[illegible] paving College St., from A[illegible] St., was let Sept. 28 to A[illegible] $1.48 a sq. yd.

CHICAGO, ILL.—Bids wil[illegible] til Oct. 19 by the Board of [illegible] sioners, addressed to William[illegible] Pub. Ser., 519 Cook County [illegible] cago, for constructing the [illegible] drive at Oak Forest, about [illegible] Chicago.

ROCKFORD, ILL.—Bids [illegible] until Oct. 15 by the city for [illegible] State Sts., with asphalt. S[illegible] Engr.

MAUSTON, WIS.—We are [illegible] that bids were received as [illegible] by M. G. Hall, Engr., Center[illegible] brick pavement on sand foundation and sand filler; Able & Brady, Winona, Minn., $1.43 sq. yd.; 35 cts. cu. yd. extra [illegible] per cu. yd. extra sand; 68 cts. per lin. ft. for combined curb and gutter; Hackworthy Construction Co., Appleton, Wis., $1.40, 30 cts., $1, 85 cts.; J. Rassmussen & Sons Co., Oshkosh, Wis., $1.24, 25 cts., $1, 56 cts.; Wholley & Hansen Co., Lacrosse, Wis., $1.47, 30 cts., 40 cts., 65 cts.; Dunn & Mead Co., Cleveland, Ohio, $1.42, 30 cts., $1, 56 cts.; Sweeney Bros., Reedsburg, Wis., $1.40, 40 cts., 50 cts., 68 cts.

LAWRENCE, KAN.—We are officially advised that JOHN RITCHIE, Topeka, Kan., has been awarded the contract by the city for furnishing materials and paving, grading and curbing Vermont St., from Euclid to Ontario Sts., 800 cu. yds. of excavation, 2,000 sq. yds. of 2-course brick paving and 1,200 ft. of limestone curbing; also for grading and paving the alley first west of Vermont St. from Henry to Warren Sts.; also for grading and paving the alley first west of Rhode Island St. from Henry to Warren Sts., the two alleys requiring 300 cu. yds. of excavation and 1,100 sq. yds. of brick paving on concrete foundation, with grout filler; also for grading and paving the alley first west of Massachusetts St. from Winthrop St. north to railway right-of-way in alley south of Pinckney St., requiring 100 cu. yds. of excavation and 900 sq. yds. of brick paving on concrete foundation, with grout filler, at $1.32 for paving, 40 cts. for grading, and 50 cts. for curbing; and $1.44 for paving alleys; and 40 cts. for grading. Bids were opened on Oct. 5. F. D. Brooks is City Clk.

KANSAS CITY, KAN.—Bids will be received until Oct. 19 by F. M. Holcomb, County Clk., Kansas City, for constructing one mile of rock road, and until Nov. 7, for constructing one mile of rock road.

OTTAWA, KAN.—Bids are asked until 5 p. m., Oct. 28, by the City Clerk for grading, curbing, guttering and macadamizing on Locust St., approximately 7,730 sq. yds., and on Maple St., from Second St. to Seventh St., approximately 7,570 sq. yds. Specifications and proposal blanks may be obtained at the office of the City Clerk. John Nelson is Mayor.

GREAT FALLS, MONT.—The contract for the treated block paving on Fourth St. South has been let to the KETTLES RIVER QUARRIES CO.

JEFFERSON CITY, MO.—Bids will be received until 4 p. m., Oct. 20, by the City Clerk, for all the labor and material necessary for the curbing, guttering, macadamizing, graveling, rolling and grading of Broadway from High St. and Broadway to Main St. and Broadway. Bids to be a price per lin. ft. for curb and guttering, and a price per cu. yd. for macadam and gravel and grading. The rolling to be done with a roller weighing not less than ten tons. Plans, specifications and estimates can be seen at the office of the City Clerk or City Engineer, where blank forms for bids may be obtained. E. F. C. Harding is City Engr.

KANSAS CITY, MO.—We are officially advised that the city is contemplating the erection of a municipal paving repair plant for the repairing of brick, macadam and asphalt pavements. Robert W. Goodnow is Secy. Bd. Pub. Wks.

TRINIDAD, COLO.—The City Council has awarded a contract to the CLEVELAND-TRINIDAD ASPHALT CO. for the paving of District No. 1, comprising the main street of the city, at $42,022, $2.75 below the Engineer's estimate. The work of laying the pavement will begin Oct. 15.

TACOMA, WASH.—The Commissioner of Public Works has awarded the paving contract in local improvement District No. 334 to N. A. JONES, at $25,125.

The paving with sandstone in local improvement District No. 406 has been awarded to WORTER BROS. F. L. Davis is City Engr.

KELSO, WASH.—The County Commissioners have appropriated the sum of $3,400 for the construction of State aid road known as the Carrollton Road.

OAKLAND, CAL.—Bids will be received until 11 a. m. Oct. 21, by the Board of Public Works, Walter B. Fawcett, Secy., for furnishing material and paving with asphalt, curbing with granite and guttering with basalt crossings of Eighth, Ninth, Tenth, Eleventh, Twelfth and 13th Sts., with salt blocks; also guttering with basalt Franklin block the full length of Franklin St., between Seventh and Twelfth Sts.

MONROVIA, CAL.—The Board of Trustees awarded a contract for street work on Grand Ave. to B. R. DAVISSON CONTRACTING CO., at $1.25 per lin. ft. for grading and oiling, 30 cts. per lin. ft. for cement curbs.

SAN MATEO, CAL.—The City Council has awarded a contract to the BARBER ASPHALT PAVING CO., Seventh and Hooper Sts., San Francisco, Cal., for asphalting in San Mateo, Cal., at about $30,000.

OGDEN, UTAH.—Bids will be received until Oct. 20 by the City Recorder for construction of cement walks in District 10, being Madison Ave. from 20th to 24th St. A. F. Parker, City Engr. Noted erroneously under Salt Lake City, Utah, last week.

VICTORIA, B. C.—The City Engineer and Assessor has recommended the paving with creosoted blocks of Belleville St., from Government St. to St. John St. Estimated cost, $28,520.

MANUFACTURING PLANTS.

(denotes that this work is advertised in Engineering News.)*

WEST RUTLAND, VT.—It has been decided by the officials of the Rutland Railway, Light & Power Co. to make the addition to the car barn at West Rutland, 150 ft. long and 42 ft. wide, instead of 60 ft. long as was planned at first. George S. Haley is Gen. Mgr., Rutland, Vt.

EAST WALPOLE, MASS.—We are officially advised that the F. W. Bird Co., East Walpole, Mass., has awarded to the ABERTHAW CONSTRUCTION CO., 8 Beacon St., Boston, Mass., the contract for building two reinforced-concrete lime kilns. These are to be built with hopper bottoms, and they will be made as nearly air tight as possible.

PAWTUCKET, R. I.—The BENJAMIN F. SMITH CO., of this city, has been awarded a contract for the erection of a 3-story and basement addition to the mill of the Blodgett & Orswell Co., manufacturers of yarns. Its dimensions will be 30 × 68 ft., and it will be built of brick with a tar and gravel roof.

BRIDGEPORT, CONN.—The plans for the new factory which George C. Batcheller & Co., of Bridgeport, Conn., manufacturers of corsets, are to erect, provide for making the structure three stories high.

DANBURY, CONN.—The Danbury Co., of Danbury, Conn., manufacturers of hats, is having plans prepared for an addition to its plant.

EAST HAMPTON, CONN.—The Bevin Bros. Mfg. Co. will erect a 1-story brick addition, 60 × 80 ft., to its plant, and raise two other buildings one story.

PLAINFIELD, CONN.—Work will shortly be commenced on an addition to the plant of the Lawton Mills Co., of Plainfield. The new structure will be of brick construction, 200 × 180 ft., and three stories high. When completed, this addition will be equipped with the latest models in cotton machinery. Cost, about $200,000.

ROCHESTER, N. Y.—The Gleason Cold Storage Co., East Ave., Brighton, has applied for a permit to remodel its plant, recently damaged by fire. The cost of reconstruction is estimated at $30000.

H. B. Graves, 74 State St., has asked for a permit to erect a 5-story reinforced-concrete building in Mill St. The cost is placed at $18,000. George C. Wright will be the Engr.-in-Charge.

BUFFALO, N. Y.—M. A. Hanna & Co., of Erie, Pa., have bought a site on the Niagara River, where $3,000,000 will be spent in erecting two furnaces which will have a capacity of 800 tons of pig iron a day. Contracts are about to be let for the building of the docks and the building of the plant itself.

It is stated that the Buffalo Smelting Works, located on the Niagara River, the Erie Canal and the Erie Railroad, between Austin and Hamilton Sts., Buffalo, N. Y., has completed arrangements for electrolytic refining copper with Niagara Falls power and has let a contract to the CROCKER-WHEELER CO., Ampere, N. J., for a 500-HP. motor generator set for 2,200-volt current, which will be installed in an addition to the plant, 200 × 350 ft., of brick and steel construction, just completed. The capacity will be 20,000,000 lbs. of cathodes a year. The CATARACT POWER & CONDUIT CO., Buffalo, has the contract for furnishing the Niagara Falls power.

The Washburn-Crosby Co., of Minneapolis, Minn., will build a brick and steel flour mill at Buffalo, of 6,000-bbl. daily capacity, at a cost of $500,000. W. N. Bevey, of Minneapolis, will have charge of the construction and the mill will be managed by F. F. Henry.

NIAGARA FALLS, N. Y.—The International Nut Co. is to erect a 2-story factory. Plans for same have been completed by Chester R. Phelps, Arch., Gluck Bldg., who will receive bids.

JAMESTOWN, N. Y.—A 5-story factory building, 60 × 230 ft., is to be erected by the Chautauqua Metal Furniture Co., City Line, as an addition to its plant and contract for same has been awarded to CHARLES SWANSON, 349 Foote Ave.

UTICA, N. Y.—E. D. & A. F. Cronk, 9 Liberty St., Utica, will build a 40 × 80 ft. factory of brick, two stories and basement, at 65 Hotel St., to be used as a machine shop for electrical repairs. Plans are being prepared by Agne, Rushmer & Jenison, Archs., Arcade Bldg., Utica.

EAST BRADY, PA.—It is reported that the Valley Yarn & Woolen Co., East Brady, Pa., will commence at once the erection of a mill to be used for the manufacture of knitting yarns. This company will make application for a charter soon, the capital stock being placed at $10,000. The incorporators are: R. W. Steele, Pres.; R. T. McNeal, Treas., and R. R. Rhodaberger, Secy.

MUNHALL, PA.—Plans have been completed by the Carnegie Steel Co. for a new plate mill to be erected at the east end of the plant at Munhall. The new building is to occupy the site of the present roundhouse and locomotive department, which are to be removed to Homestead. Cost, approximately $800,000.

SCRANTON, PA.—A charter has been granted the W. A. Lush Silk Co., a corporation organized for the purpose of throwing, weaving and manufacturing silk, silk fabrics, etc., in the city of Scranton. The capital stock of the company is $50,000. The directors are W. A. Lush, William Marsden and David R. John, all of Scranton. The plant of the company is situated in North Scranton and is nearing completion.

CHARLOTTE, N. C.—Fancy cotton goods are to be manufactured here by the Cavona Mfg. Co., which has been incorporated with a capital stock of $100,000. It is understood that a suitable building has been secured and that contracts for the machinery have been awarded. W. A. Shullenberger and Alexander & Garsed are the organizers.

SHELBY, N. C.—The erection of an addition to hold 9,000 spindles is being planned by the Shelby Cotton Mills of Shelby. Contracts for machinery and building will soon be awarded. Electricity will be used. The present equipment comprises 10,000 spindles and 250 looms. C. C. Blanton is Pres.

JACKSONVILLE, GA.—The Savannah Locomotive Works & Supply Co., Savannah, Ga., contemplates the establishment of a branch plant at Jacksonville, Fla.

UNION, MISS.—R. J. Buckwalter, of Wingate, Miss., has awarded contract to J. G. McDONOUGH, of McDonough Mfg. Co., Eau Claire, Wis., for erection of a sawmill. It will be built of steel and concrete, 48 × 180 ft., with addition 22 × 75 ft., two stories, daily capacity 60,000 ft., with provision to increase to 100,000 ft. About nine miles of standard-gage railroad will be constructed at cost of about $50,000.

NEW ORLEANS, LA.—People's Cooperative Laundry Co., 919 Maison Blanche Bldg., will establish a laundry. The company will erect a 2-story fireproof building, about 90 × 200 ft., at $20,000; cost of machinery, $5,000; will receive bids on machinery until Oct. 25. John L. Lenfant is Pres.; Manuel Cerda, Vice-Pres.; John H. Herman, Jr., Treas.; James S. Phillpot, Secy.

JOHNSON CITY, TENN.—JOHN H. BAYLESS has the contract for the erection of a fireproof concrete and brick laundry building, 60 × 100 ft., for the Johnson City Steam Laundry. Estimated cost, $10,000.

FARMERS, KY.—The Licking River Lumber Co., F. G. Eberhardt, Jr., Pres., Ashland, Ky., will expend from $10,000 to $12,000 in rebuilding its burned plant. The company will erect frame buildings. R. G. Page is Arch. and Engr.-in-Charge. Capacity of plant, 40,000 ft. lumber daily.

ANDERSON, IND.—Bids are asked until Nov. 1 by A. H. Hicke, Pres. of the Sefton Mfg. Co., for the erection of an addition to the plant in this city.

SELBYVILLE, IND.—The Root Furniture Mfg. Co. has decided to rebuild the factory recently destroyed by fire. The new plant will be larger than the old one.

CHICAGO, ILL.—We are officially advised that the Wisconsin Steel Co. has awarded contract to the McCLINTOCK-MARSHALL CONSTRUCTION CO., 1063 Grand St., Pittsburg, Pa., for constructing an addition to its mill at 106th and 108th Sts. and Torrence Ave.

OTTAWA, ILL.—The Chicago Retort & Fire Brick Co., 45th St., between Clark and La Salle Sts., Chicago, has had plans made for an addition, 152 × 118 ft. to its Brickton plant. Cost, about $15,000.

RACINE, WIS.—A. C. Kappel has secured a contract to erect a 2-story factory building for the S. C. Johnson Co., to cost $10,000.

The Racine Mfg. Co. is receiving bids for a 4-story brick building to cost from $7,000 to $10,000. It will be used in the main for a power plant. It is stated that the company is figuring on another building to the west.

SHAWANO, WIS.—The contract for rebuilding the paper mill at West Shawano has been let to ULE & DE GUERE, of Grand Rapids, for approximately $16,000. Two paper machines will be placed and a 70 × 100-ft. finishing room added.

MILWAUKEE, WIS.—We are officially advised that H. C. Koch & Son, Archs., 1040 Wells Bldg., have prepared plans for a 6-story structure at 240 Broadway, for the A. Breslauer Co. It will be occupied by S. Fein Bros., wholesale notions and dry goods, and will be owned by the A. Breslauer Co. The building will be 40 × 120 ft. and will cost $40,000. The following contracts have been let: Masonry, WILLIAM WINTER; carpentry, HENRY WALLSCHLAEGER; heating, C. J. FOX, 616 Grand Ave.; plumbing, H. C. WILLIAMS, 241 Broadway.

OMAHA, NEB.—Shepard & Farrar, Archs., Minor Bldg., Kansas City, Mo., are preparing plans for a factory building, at Omaha, for the Loose-Wiles Candy & Cracker Co.

EL PASO, TEX.—The Globe Grain & Milling Co., 925 East Third St., Los Angeles and San Francisco, Cal., proposes to construct a $125,000 flour mill in El Paso.

MARSHALL, TEX.—J. C. BEASON has secured the contract for building a brick and iron addition, 30 × 70 ft., for the Marshall Car Wheel & Foundry Co.

MUSKOGEE, OKLA.—G. Sleeper, of Muskogee, and A. V. Baumann, of Fremont, Ohio, are interested in the erection of a packing plant here, to cost $250,000.

SPOKANE, WASH.—F. C. and D. S. Smalley, of Galesburg, Ill., propose to erect in Spokane a factory to cost $200,000.

PORTLAND, ORE.—The American Chicle Co. has purchased a site at 14th and Johnson Sts., Portland, and a 4-story factory building will be erected at once. The new building will cost about $40,000.

FRESNO, CAL.—The Morton Gas Engine Co. will establish a factory at Fresno. It is said $10,000 will be expended.

DOUGLAS, ARIZ.—W. E. Harrison will commence the construction of a 2-story concrete building at Brewery Gulch. It will be used for cold storage and bottling purposes. From $15,000 to $20,000 will be expended.

VANCOUVER, B. C.—The Algonquin Lumber Co., Toronto, Ont., has purchased the holdings of the Quatsino Lumber Co. and will erect a pulp mill at a cost of $250,000.

MISCELLANEOUS CONTRACTS.

U. S. RECLAMATION SERVICE.—All news relative to canal projects, etc., will be found under Water Supply—Irrigation.

(denotes that this work is advertised in Engineering News.)*

DRAINAGE.—DeKalb, Ill.—Bids are asked by the Drainage Commissioners, Union District No. 1, until noon, Oct. 23, for construction of a tile drain. Wm. Schafer, Clk.

*DREDGING.—Galveston, Tex.—Bids are asked by Capt. John C. Oakes, Corps Engrs., U. S. A., Galveston, until noon, Nov. 14, for dredging in Buffalo Bayou, Tex.

DRAINAGE.—Algona, Iowa.—Bids are asked by A. L. Anderson, County Audr., Algona, until 2 p. m., Oct. 16, for constructing open ditch and the drains in Drainage District No 30, Kossuth County.

*DREDGE.—Mobile, Ala.—Bids are asked by Maj. H. Jervey, Corps Engrs., U. S. A., Mobile, until noon, Nov. 20, for constructing a steel hull 20-in. pump dredge for improving harbors on the coast of Mississippi.

JETTY.—Boston, Mass.—Bids are asked until 2 p. m., Oct. 23, by the Board of Harbor and Land Commissioners, for building a stone jetty at entrance to Sesuit Harbor, East Dennis, Mass. Frank W. Hodgdon, Ch. Engr.

FLOATING WRECK.—Washington, D. C.—Contract has been let by Victor H. Metcalf, Secy. of the Navy, Washington, to float the cruiser "Yankee," ashore off Spindle Rocks, at the entrance to Buzzard's Bay, to JOHN ARBUCKLE, of New York.

IRON GATES.—Washington, D. C.—Bids will be received until Oct. 29, by Major M. Gray Zalinski, Q. M., U. S. A., Washington, D. C., for constructing and erecting ornamental iron gates at Hampton and Salisbury National Cemeteries.

SEAWALL.—Boston, Mass.—Bids were received on Oct. 5 by the Metropolitan Park Commission, 14 Beacon St., Boston, for constructing a seawall at the Winthrop Shore Reservaton. The contract has been let to HAMLIN & RYAN, of Salem, Mass. John R. Rablin is Engr.

RETAINING WALL.—New York, N. Y.—Bids are asked by George Cromwell, Pres. Boro. of Richmond, until noon, Nov. 10, for constructing a reinforced-concrete retaining wall on Stuyvesant Pl., and other work in connection with the St. George Ferry approach.

OIL.—New York, N. Y.—Bids are asked until 3 p. m., Oct. 29, by the Park Board, Henry Smith, Pres., for furnishing and delivering Texas road oil (No. 1, 1908) for parks, Boro. of the Bronx; also for 10,000 gallons of crude petroleum oil (No. 1, 1908) for parks, Boro. of the Bronx.

*DRAINAGE.—Cerro Gordo, Ill.—Bids are asked by the Commissioners of Union Drainage District No. 3, Cerro Gordo and Willow Branch Townships, Platt County, Ill., until 1 p. m., Oct. 30, 1908, for furnishing, hauling, laying and back filling various quantities of various size vitrified red clay or shale tile.

DITCH.—Cerro Gordo, Ill.—Bids were received as follows on Oct. 8 by J. C. Locher, Town Clerk, for construction of ditch. Estimated quantity to be excavated, 60,000 cu. yds. W. J. Day, Bement, Ill., is Engr.: 60,702 cu. yds. dredge boat work, W. C. McGinnis, Atwood, Ill., 13½ cts.; 2,863 cu. yds. scraper work. H. S. Walker, Cisco, Ill., 90 cts.

DITCH.—Mt. Carmel, Ill.—The Commissioners of Drainage District No. 2, on Sept. 22 awarded the contract for the construction of a ditch, seven miles long, to CARTER BROS., of Danville, Ill., at 14.98 cts. per cu. yd. Other bidders were: Leach Bros., Golden Gate, 21 cts.; Fred Morgan, Vincennes, 19 cts.

COAL AND ASH HANDLING APPARATUS.—Charleston, S. C.—Bids are asked until 11 a. m., Nov. 14, by William M. Smith, Ch. of Bureau, Navy Dept., Washington, D. C., for installing a coal and ash handling plant at the central power station, Navy Yard, Charleston, S. C. Specifications are on file at the office of Engineering News, New York.

DRAINAGE CANAL AND LEVEE.—Clarksdale, Miss.—The contracts for developing a drainage district in the delta of the Mississippi are to be awarded on Oct. 24. About 30 miles of canal have been located, but the plans and specifications upon which the contracts are to be let have not yet been prepared. J. M. Oliphant, Clarksdale, Miss., is Supervising Engineer for the Yazoo-Mississippi Delta Levee District.

*WHARF, SEAWALL.—Mobile, Ala.—Bids were received as follows on Oct. 9, by Maj. H. Jervey, Corps Engrs., U. S. A., for construction of a wharf and seawall at Fort Gaines, Dauphin Island, Ala.: Hieronymus & Ollinger, Mobile, Ala., $79,723; Richard M. Murphy, New Orleans, La., $70,542; W. C. Spotswood, Mobile, $71,716; Blackstaff Engineering Co., Philadelphia, Pa., $79,478; Charles Clarke & Co., Galveston, Tex., $81,648; Edwards Construction Co., Tampa, $128,000; Grant Wilkins, Atlanta, Ga., $81,808; Christie & Lowe, New Orleans, La., $67,390.

CONTRACT PRICES.

[Where * precedes item under Contract Prices the work was advertised in Engineering News.]

BARGE CANAL.—Albany, N. Y.—Bids were received by F. C. Stevens, Supt. of Public Works, on Oct. 1, for Barge Canal Contract No. 61, which is for the improvement of 7.39 miles of canal between the west end of Contract No. 60 to the west line of Monroe County. Itemized bids were as follows: (1) Engineer's estimate; (2) E. M. GRAVES, Cleveland, Ohio (awarded contract); (3) Empire Engineering Corporation, 60 Wall St., New York:

		(1)	(2)	(3)
7.4	miles cofferdams, pumping, bailing draining ..	$2,000.00	$2,000.00	$2,000.00
	Clearing (lump sum)	2,400.00	2,400.00	2,400.00
48,500	cu. yds. grubbing	.30	.30	.36
947,500	cu. yds. excavation	.55	.60	.58
20	M. ft. B. M. sheeting and bracing per M. ft..	50.00	50.00	50.00
564,000	cu. yds. forming embankment, first-class	.15	.15	.18
96,000	cu. yds. forming embankment, second class..	.12	.12	.14
18,900	cu. yds. lining	1.50	1.50	1.50
13,900	cu. yds. puddle	2.00	2.00	2.17
11	M. ft. B. M. sawed lumber (yellow pine or Douglas fir), per M. ft.	55.00	55.00	55.00
3,400	lin. ft. foundation piles	.30	.30	.30
5	M. ft. B. M. wooden sheet piling, per M. ft. B. M.	55.00	55.00	55.00
65	cu. yds first-class concrete	8.00	8.00	9.00
9,720	cu. yds. second-class concrete.....	7.50	7.50	9.00
1,030	cu. yds. third-class concrete	6.00	6.00	7.20
350	cu. yds. reinforced concrete	10.00	10.00	12.20
8	cu. yds. first-class masonry bridge coping	30.00	30.00	30.00
1,500	cu. yds. dry retaining wall, including coping.	2.50	2.50	2.50
63,700	cu. yds. wash wall	2.50	2.50	2.80
350	sq. yds. second-class stone paving.....	1.50	1.50	1.50
1,200	sq. yds. third-class stone paving.....	1.25	1.25	1.25
275	sq. yds. cobblestone paving.....	1.00	1.00	1.00
280	cu. yds. third-class riprap	2.50	2.50	2.50
39,900	lbs. c.-i. pipe and specials	.03½	.03½	.03½
148	lin. ft. 12-in. vitrified pipe laid.....	.75	.75	.75
110	lin. ft. 24-in. vitrified pipe laid.....	2.50	2.50	2.50
443,600	lbs. structural steel	.05	.05	.05¼
43,000	lbs. metal reinforcement	.04	.04	.04
820	sq. yds. wood pavement, 2¾ ins. thick	2.75	2.75	2.75
220	sq. yds. wood pavement, 3¾ ins. thick	3.00	3.00	3.00
8,500	lin. ft. wooden fence	.20	.20	.24
660	lin. ft. wrought iron pipe railing.....	1.00	1.00	1.00
330	lin. ft. lattice railing	1.50	1.50	1.50
3	gates, standards and operating machinery, ea.	250.00	250.00	250.00
900	sq. ft. relaying board walks.....	.05	.05	.05
1,000	lin. ft. repointing old masonry	.05	.05	.05
1,400	lin. ft. drilling bolt holes in old masonry ...	.60	.60	.60
	For maintaining navigation (lump sum)	10,000.00	10,000.00	10,000.00
	For maintaining highway traffic (lump sum)..	2,000.00	2,000.00	2,200.00
	Deduct price to be paid to the State of New York, for buildings in place, which are to be removed by the contractor without expense to the State (lump sum).....	2,000.00	1,000.00	2,000.00
	Deduct price to be paid to the State of New York for bridge superstructures in place which are to be removed by the contractor without cost to the state (lump sum)	300.00	300.00	300.00
	Totals	$1,000,219	$1,047,994	$1,092,748

U. S. POSSESSIONS AND CUBA.

HOSPITAL.—Porto Rico.—Bids are asked until 11 a. m., Oct. 19, by Maj. M. Gray Zalinski, Depot Q. M., U. S. A., Washington, D. C., for the construction, plumbing and electric wiring of a hospital building to be erected at San Juan, P. R.

LOCOMOTIVES.—Panama.—Bids are asked until 2 p. m., Oct. 28, by Maj. Wendell L. Simpson, Commissary Purchasing Agt., Panama R. R. Co., 24 State St., New York, for furnishing twelve Mogul type freight locomotives.

CRANES.—Panama.—Bids will be received by the General Purchasing Officer, Isthmian Canal Comn., at Washington, D. C., on Oct. 27 (extension of date from Oct. 17) for four berm and four chamber cranes.

STEEL DOORS AND SHUTTERS.—Philippines.—Bids are asked until noon, Oct. 20, by Lieut.-Col. W. S. Roessler, Army Bldg., New York, N. Y., for furnishing steel doors and shutters for fortifications in the Philippine Islands.

STOREHOUSE.—Honolulu, H. T.—Bids are asked by Maj. George McK. Williamson, Q. M., U. S. A., Fort Mason, San Francisco, Cal., until 9 a. m., Oct. 30, for constructing, plumbing and wiring a concrete storehouse at Honolulu, H. T.

MANILA ROPE.—Panama.—Bids were received as follows Oct. 12 at the office of the Isthmian Canal Commission for a quantity of manila rope for the Commission: Griscom, Spencer Co., 90 West St., New York, $24,808. Hibbard, Spencer, Bartlett & Co., Chicago, unit prices, 10.15 cts. to 11.15 cts. per lb; Manhattan Supply Co., New York, $29,232, $27,938. Plymouth Cordage Co., Plymouth, Mass., $23,196. American Mfg. Co., New York, $24,696.

DERRICKS.—Panama.—Bids were received as follows Oct. 12, at the office of the Isthmian Canal Commission for the following equipment: Item 1, ten derricks; Item 2, ten hoisting engines; Item 3, 40 derrick skips: American Hoist & Derrick Co., St. Paul, Minn., $26,908; $29,169; $25,123; $27,125; $27,385; $22,994; $25,255; $21,210; $23,471; $22,757; $25,018, $29,973; $23,234. Contractors' Plant Mfg. Co., Ltd., Buffalo, N. Y., $21,060; $20,710. Dietrich Bros., 346 North St., Baltimore, Item 3, $2,640. Dobbie Foundry & Machine Co., 82 Warren St., New York, Item 1, $9,375, $9,879; Item 2, $13,640; Item 3, $4,668, $5,050. G. & W. Mfg. Co., 26 Cortlandt St., New York, $21,300 $20,800; Hoisting Machinery Co., 50 Church St., New York, $24,253. Lenher Engineering Co., 149 Broadway, New York, $24,874. Lidgerwood Mfg. Co., 96 Liberty St., New York, Item 1, $8,213, $8,731; Item 2, $11,385, $13,735; Item 3, $2,674. Motley, Green & Co., 66 Broad St., New York, $21,450. J. S. Mundy, Newark, N. J., Item 1, $9,430, $7,910; Item 2, $12,000, $9,000; Item 3, $4,880. National Equipment Co., Chicago, Item 1, $6,446. New Jersey Foundry & Machinery Co., 90 West St., New York, Item 1, $10,730; Item 3, $3,040. J. Jacob Shannon & Co., Philadelphia, $21,980. Williamson Bros. Co., Philadelphia, $26,100.

CIVIL SERVICE EXAMINATIONS.

PREPARATOR.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Oct. 28-29, Nov. 2, to secure eligibles from which to make certification to fill a vacancy in the position of Entomological Preparator, $50 a month, in the Bureau of Entomology, Dept. of Agriculture, and vacancies requiring similar qualifications as they may occur in that department. Age limit, 20 years. Application Form 304.

AID.—Washington, D. C.—The U. S. Civil Service Commission announces the postponement to Nov. 11, of the examination scheduled for Oct. 28, to secure eligibles from which to make certification to fill a vacancy in the position of Aid (male), in the Division of Insects, National Museum, at $75 a month, and vacancies requiring similar qualifications as they may occur in that Museum. Age limit, 18 years. Application Form 1093.

CHEMICAL BACTERIOLOGIST.—Washington, D. C.—The U. S. Civil Service Commission will hold an examination on Nov. 5 to secure eligibles from which to make certification to fill a vacancy in the position of Chemical Bacteriologist (either sex), in the Bureau of Chemistry, Dept. of Agriculture, at $1,200 a year, and vacancies requiring similar qualifications as they may occur in that department. Age limit, 20 to 45 years. Application Form 1312.

INSPECTOR OF SUPPLIES.—San Francisco, Cal.—The U. S. Civil Service Commission announces an examination on Nov. 17, to secure eligibles from which to make certification to fill a vacancy in the position of Inspector of Regular Supplies, Quartermaster's Department at Large, San Francisco, Cal., at $1,500 a year, and vacancies requiring similar qualifications as they may occur in that department. Age limit, 20 years. Application Form 1093. Applications must be filed prior to closing hour on Nov. 6.

LABORATORY CHIEF.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Nov. 9, to secure eligibles from which to make certification to fill a vacancy in the position of Chief of the Cattle and Grain Investigation Laboratory, Bureau of Chemistry, Dept. of Agriculture, at $2,500 a year, or less, and vacancies requiring similar qualifications as they may occur. Age limits, 25 to 45 years. Application Form 304 and special form. Applications must be filed prior to closing hour on Nov. 9.

ELECTRICAL ENGINEER.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Nov. 9, to secure eligibles from which to make certification to fill a vacancy in the position of Electrical Engineer in the Technologic Branch, Geological Survey, at a salary ranging from $1,620 to $3,000 a year, according to the rating received, and vacancies requiring similar qualifications as they may occur. Age limit, 21 years. Application Form 304 and special form. Applications must be filed prior to closing hour on Nov. 9.

ASSISTANT IN AGRICULTURAL EDUCATION.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Nov. 9, to secure eligibles from which to make certification to fill two vacancies in the position of Assistant in Agricultural Education in the Office of Experiment Stations, Dept. of Agriculture, at salaries ranging from $1,400 to $1,800 a year, and vacancies requiring similar qualifications as they may occur in that department. Age limit, 21 to 40 years. Application Form 304 and special form. Applications must be filed prior to closing hour on Nov. 9.

SPECIAL EXAMINERS AND SPECIAL AGENTS.—Washington, D. C.—The U. S. Civil Service Commission will hold an examination on Nov. 17, to secure eligibles from which to make certifications for the appointment of Special Examiners and Special Agents in the Bureau of Corporations, Dept. of Commerce and Labor, as the needs of the service may require, at salaries ranging from $1,200 to $3,500 a year, except that for Group D positions the minimum salary will be $900 a year. The salaries of these positions are not fixed by law, but their amount is determined by the Secretary of Commerce and Labor on the recommendation of the Commissioner of Corporations in accordance with the work to be done and the qualifications desired in each case. Application Form 1586.

INDUSTRIAL NOTES.

THE DEGNON CONTRACTING CO. has recently removed one block of Wyckoff creosoted wood conduit, 24-duct run, the property of the Empire City Subway Co., from Sixth Ave., between 18th and 19th Sts., New York City, owing to excavation for the Hudson River tunnels. This conduit was laid in 1887 and was removed in June, 1908, and after 21 years was sound and without the least sign of decay in any instance. Documentary proof of the above facts will be furnished by The Wyckoff Pipe & Creosoting Co., Inc., and samples are on exhibition at the office of the company, 50 Church St., New York City. This conduit is being stored, as it was taken up without breakage, except a portion where it was inexpedient to pull the cables and interrupt the service. The company has over 9,000 miles of this conduit in service, carrying telephone cables, signal and electric light wires carrying 3,000 volts and over in many cases.

For other Proposal Advertisements see pages 47, 48, 49, 50, of Advertisements and Construction News page 138.

U. S. ENGINEER OFFICE, Galveston, Texas, Oct. 14, 1908.—Sealed proposals, in duplicate, for dredging in Buffalo Bayou, Tex., will be received here until 12 noon, Nov. 14, 1908, and then publicly opened. Information on application. JOHN C. OAKES, Capt., Engrs.

OFFICE COMMISSIONERS, DISTRICT OF COLUMBIA, Oct. 9, 1908.—Sealed proposals will be received at this office until 12 o'clock, noon, November 2, 1908, for constructing the Congress Heights Trunk Sewer in the District of Columbia. Forms of proposals, specifications, and necessary information may be obtained from Chief Clerk, Engineer Department, Room 427 District Building, Washington, D. C. HENRY B. F. MACFARLAND, HENRY L. WEST, JAY J. MORROW, Commissioners, D. C.

Situations Wanted

Civil Engineers.

CIVIL ENGINEER, with eight years' varied experience as draftsman and in charge of construction on levee work, building, in brick and concrete, heavy wharf construction (steel), pile driving on land and water, also laying out railway track, wishes engagement; full references as to experience, training and character given on application and all correspondence considered confidential. Address "F. 16," Engineering News, New York. 16-2t

CIVIL ENGINEER, eight years' experience in municipal engineering, railway location and construction, real estate development, highway construction, land drainage. Address "D. 16," Engineering News, New York. 16-1t

Surveyors.

COOPER INSTITUTE STUDENT (21), 3 years' experience as rodman, chainman, instrumentman and draftsman, desires position; references. Address "A. A. 15," Engineering News, New York. 16-1t

EXPERIENCED SURVEYOR and mechanical draftsman desires opportunity to get experience on railroad construction; or with contracting engineer; any capacity; moderate salary. Address "TURNER," 87 Main St., Charlestown, Mass. 16-1t

Superintendents, Misc., etc.

TECHNICAL GRADUATE, several years' experience elevating, conveying and transmission machinery, desires position as engineer or salesman. Address "H. A. 16," Engineering News, New York. 16-1t

A MEMBER OF THE AMERICAN SOCIETY of Mechanical Engineers, 36 years old, wishes a position as superintendent or chief engineer with reputable people who can afford to pay for the best talent. Address "C. 16," Engineering News, New York. 16-5t

YOUNG MAN (23), not afraid of work, wants position with contractor or engineer; 3 years' experience as chainman, rodman and timekeeper on railroad construction; references; go anywhere. Address "B. 16," Engineering News, New York. 16-4t

RUSSIAN ENGINEER, now engaged in America expects to return home and wishes to enter into correspondence with American firms desiring to promote their business, etc., in European and Asiatic Russia. References. Address "V. A. 16," Engineering News, 1636 Monadnock Block, Chicago. 16-3t

SUPERINTENDENT open for engagement, expert concrete and general construction man, designing and building of form work; practical outside man; showing results in economy, speed and quality of work. Address "I. A. 16," Engineering News, New York. 16-3t

Situations Open

WANTED—An ornamental iron draftsman; one who has had some experience in assisting taking measurements at buildings. State age, experience; married or single, and salary expected. Address "G. A. 16," Engineering News, New York. 16-3t

Miscellaneous Wants

WANTED

One or Two Engineers

with from $2,000 to $5,000, to take an interest in concrete construction work. Immediate business; must be active and speak the English language; working around Greater New York. Address "K. A. 16," Engineering News, New York. 16-2t

I Will Pay a Commission

or give an interest in the profits to any one influencing or obtaining contracts for concrete work. Communications confidential. WM. FICKLEN CO., 1 Madison Ave., City. 16-3t

FOR SALE

Heading and Reheading Machine

FOR SALE

A Waterbury-Farrel No. 2½ Heading and one No. 2½ Reheading Machine; never used; brand new; warranted; bargain.

OHLEN COMPANY,
Box 740, Columbus, Ohio. 16-2t

FOR SALE.

One 16" × 10"

B "Farrel" Crusher

with 24" standard three section sizing screen, dust pocket, bins and elevator complete, with 25 Horse Power Center Crank Engine mounted on 40 Horse Power Locomotive Boiler, with all fixtures and fittings; an up-to-date plant in the best of condition, having been used but eight months.

A No. 2 Ransome concrete mixer mounted on skids with boiler and engine, charging hopper and all fixtures complete; purchased new last season; also three steam drills.

Inquire LONG and LITTLE, Box 145 Waterbury, Conn. 16-3t

FOR SALE.

One No. 976, 70-ton Bucyrus steam shovel, 3-yd. dipper; one No. 647, 95-ton Bucyrus; one No. 1355, Model 60 Marion; one No. 30,942, Atlantic type, 3-yd. dipper; 2 standard-gage, 45 ton, 10-wheel Baldwin type locomotives; 2 standard-gage, 35 ton; one 25-ton pull wheel switch-loader; one Marion center Lidgerwood unloader; one No. 1543; one right-hand plow, No. 1523; one left-hand plow, No. 1525; one Western Wheeled Scraper Co. spreader; one No. 3 Keystone self-propelling driller, machine No. 1462; pile driving outfit and other miscellaneous tools comprising contractor's outfit.

WABASH CONSTRUCTION COMPANY,
Terre Haute, Indiana. 16-2t

FOR SALE.

Stone Crushing Plant

complete, consisting of one No. 6 Austin Gyratory crusher, one No. 3 Austin Gyratory crusher, one No. 2½ Climax Jaw crusher, one battery of boilers, two engines, screens, elevators, bins, etc. Will be sold as it stands.

Also another crushing plant consisting of one No. 4 and one No. 2½ Climax Jaw crusher, intermediate screen, bin screen, elevators, etc.

Also second-hand asphalt plant, consisting of three melting kettles, four drums, oil tanks, etc.

All the above will be sold at a bargain.

Full information upon application to THE BRENNAN CONSTRUCTION COMPANY, No. 3056 K Street N. W., Washington, D. C. 16-2t

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OF THE

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Fine foundry and other buildings; cost $50,000; modern machinery; raw material; manufactured goods; fully equipped office building; valuable wharf; whole representing a recent outlay of approximately $150,000.

The plant is in splendid shape to immediately resume business. It is admirably located on tidewater and adjacent to the tracks of the New York, New Haven & Hartford Railroad.

A detailed description of its contents and complete particulars will be furnished upon application to

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Power Station Equipment For Sale

(On account of Construction of New Power Plant.)

2—500 Horse Power Wetherill Cross Compound Engines, 20" × 36" × 48". Direct connected to 14" × 24" Condensers equipped with Monarch Engine Stop and Speed Limit.

1—13 × 20 × 17 Tandem Compound Harrisburg Ideal Engine. Fly Wheels 16" × 80". 150 Horse Power.

1—16-inch × 26-inch × 18-inch Tandem Compound Springfield Ide Engine. Belt Wheel 30" × 96". Governor Wheel 16" × 96". 325 Horse Power.

1—Webster Vacuum Feed Water Heater, 32" × 32" × 48"

1—Whitelock Feed Water Heater. Outside diameter of Drum, 2' 7". Length, 5' 6". Heater is fitted with an exhaust valve, and about 30 feet of 14-inch riveted pipe.

1—Steam Separator, 30-inch diameter, 10 feet long.

4—Harrisburg Return Tubular Boilers; Shell 6-ft. diameter, 18 feet long. Eighty-two (82) 3½" tubes.

2—Harrisburg F. & M. Return Tubular Boilers, 15' × 72"; 110—3-inch tubes.

2—Harrisburg F. & M. Return Tubular Boilers, 16' × 72"; 110—3-inch tubes.

ALL IN OPERATING CONDITION.

Address for terms etc., CENTRAL PENN'A TRACTION CO., Harrisburg, Penn'a. 16-2t

AIR COMPRESSORS

A large number of the highest class air compressors are for sale. They were mostly supplied by the Ingersoll-Rand Company for the Pennsylvania East River Tunnels, New York, and are in splendid condition, They are 14 Compound Steam Corliss Air Compressors, 5 slide valve Steam Compressors. Also, two electrically driven Laidlaw-Dunn-Gordon Compressors.

There is also a great deal of other general plant and equipment, consisting of pumps, boilers, steam locomotive derricks, stiff leg derricks, electric generator sets and rotary converters, winches, rock drills, pipes and fittings, etc. Apply to

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